McGRAW-HILL HOME ECONOMICS SERIES
ANNIE LOUISE MACLEOD, PH.D., CONSULTING EDITOR

PSYCHOLOGY OF INFANCY AND EARLY CHILDHOOD

The quality of the materials used in the manufacture of this book is governed by continued postwar shortages.

McGRAW-HILL HOME ECONOMICS SERIES

Annie Louise Macleod, Ph. D., *Consulting Editor*

Arlitt · Psychology of Infancy and Early Childhood

Arlitt · Family Relationships

Bailey, Laton, and Bishop · Studying Children in School
Workbook I—*Study of Child in Preschool*
Workbook II—*Study of Child in Elementary School*
Workbook III—*Study of Youth in Secondary School*

Burrell · Organic Chemistry

Hawley · Economics of Food Consumption

Macleod and Nason · Chemistry and Cookery

Nason · Introduction to Experimental Cookery

Osborn · Physics of the Home

Sherbon · The Child

Sherbon · The Family in Health and in Illness

Wagoner · The Development of Learning in Young Children

Wagoner · Observation of Young Children

Woodhouse · Business Opportunities for the Home Economist

Young · Clothing the Child

Psychology of Infancy and Early Childhood

BY

ADA HART ARLITT, Ph. D.

Professor of Child Care and Training,
University of Cincinnati

Third Edition
Second Impression

New York *London*
McGraw-Hill Book Company, Inc.
1946

PSYCHOLOGY OF INFANCY AND EARLY CHILDHOOD

PRINTED IN THE UNITED STATES OF AMERICA

MARTIN J. POLLAK, INC. • PRINTERS • NEW YORK

TO

M. CAREY THOMAS

PRESIDENT EMERITUS OF BRYN MAWR COLLEGE

PREFACE TO THE THIRD EDITION

Although there have been very few shifts in viewpoint in child psychology since 1930, the number of researches in all of its various fields has increased materially. In this volume the major researches of the past fourteen years are included together with much additional material in the field of learning, imagination, memory, and the relative effects of heredity and environment.

Ada Hart Arlitt.

Cincinnati, Ohio,
January, 1946.

PREFACE TO THE FIRST EDITION

FROM THE POINT OF VIEW OF HEALTH, OF EDUCATION, OF personality development, and of mental hygiene, recent studies have proved that the most important period of the child's life is the first five years. Among the most important of the studies have been the laboratory researches in child behavior and the observations of the behavior of individual children. These studies have added enormously to our knowledge of child psychology, at the same time that researches in mental hygiene, in child health, and in education have shown us the need of as complete a knowledge of the psychology of the preschool period as can be obtained.

Only one instance out of many may be cited to prove the relation of psychology to child health. Malnutrition constitutes by far the most common physical defect of the preschool period. Emerson cites as the second, fourth, and fifth on the list of the five causes of malnutrition: "lack of home control, faulty food habits and improper food, and faulty health habits." Each of these three causes listed by Emerson is traceable in a large measure to a lack of knowledge of child psychology, or to a lack of appreciation of the general principles of habit formation. The best diet list is useless if the child, because of improper training or suggestion, refuses to eat. Apparently eating in itself is inadequate if the other health habits do not accompany it.

Just as parent and teacher alike must meet the problems which arise in connection with health habits, so both must meet problems of discipline, problems of rewards and punishments, problems in moral and ethical training, and the

whole series of problems, which arise in giving a standard of education to children; while at the same time both must have respect for individual differences. To meet each of these groups of problems, a knowledge of the psychology of early childhood is essential. This is so not only where the child with whom one deals is five years old or under, but also when the children under consideration have passed beyond that period. The behavior of a child in the kindergarten and in the primary grades, and his ability to take the education which is offered at that time, are based, in large measure, on the experiences which he has received in the period before school age, and on the attitudes and capacities which he has developed because of these experiences. The best school is seriously handicapped in helping a child to learn if he brings to his classes a stubborn and antagonistic attitude, or such great timidity that he refuses to take part in any work, be it group or individual, or so poor a background of experience that the words used in his group have little or no meaning for him.

This book has been written for the purpose of so presenting those principles of psychology, derived from early studies and the material drawn from later researches, that they can be used by parents, teachers, and others interested in young children—all of whom must meet the problems listed above and also those problems which, though treated later, have, for lack of space, not been included in the preface.

It would be impossible to state in detail in the introduction to this volume all of those on whose work the text is based. Such statements are made in the body of the text. The author wishes, however, to acknowledge her debt to the work of Dr. John B. Watson and his students, and

to the work of Dr. Bird T. Baldwin, Dr. Arnold Gesell, and Dr. Helen T. Woolley.

The writer is deeply indebted to Dr. Harvey A. Carr for reading this manuscript and for innumerable suggestions as to material to be included. The writer is also indebted to Dr. C. Judson Herrick for reading and criticising the section of the manuscript which deals with the nervous system. To Miss Berta Harper, who has edited this manuscript with a view to its form and to Miss Elizabeth Dyer, Dr. Constance Dowd, and Miss Flora Thurston, who have given valuable suggestions as to content, the author wishes to express thanks.

The writer wishes to acknowledge her indebtedness to the following authors and publishers for their courtesy in permitting material from their books to be reprinted: Dr. Bird T. Baldwin, Dr. H. A. Carr, Dr. W. B. Cannon, Dr. A. I. Gates, Dr. Arnold Gesell, Dr. Walter S. Hunter, Dr. Carl Murchison, and D. Appleton & Company, The Pedagogical Seminary and Journal of Genetic Psychology, Henry Holt & Company, Longmans, Green and Company, Alfred A. Knopf, Inc., The Macmillan Company, Rand, McNally & Company, and The University of Chicago Press. Selections from L. M. Terman and Jessie C. Fenton are used by permission of and by arrangement with Houghton Mifflin Company.

Ada Hart Arlitt.

Cincinnati, Ohio,
March, 1928.

CONTENTS

APPROACHES TO THE STUDY OF CHILD PSYCHOLOGY

PSYCHOLOGY IN ITS INFANCY WAS LARGELY A LABORATORY science. It consisted of experiments on students conducted with the use of apparatus and in laboratories. It was rarely an actual study of human beings functioning normally in an everyday environment. The results which laboratory experiments yielded were excellent insofar as they went, but up to the time of Freud, psychology was progressing rapidly toward the state of a pure science without application either to life or to human behavior. In a word, experimentation had yielded better and better techniques and more and more elaborate apparatus without at any time giving clear knowledge of human behavior, except under laboratory conditions and with the apparatus employed.

Fortunately, Freud, together with Jung and Adler, demonstrated clearly that there was a side to human behavior not only as important as that revealed by experimentation, but actually more important for human adjustment.

Child psychology began not in the laboratory, but with reminiscence, observation of individual children, and data

from questionnaires. It has rapidly progressed to the stage of laboratory experimentation. In fact, experimentation appears to be swamping all other types of approach in a mass of data interesting enough but not always applicable to life or useful in the interpretation of infant and child behavior. Before child psychology reaches the stage which general psychology had approached before Freud it might be well to study the methods used to date and to evaluate each as a source of data and as a technique to use in further research. These methods are hereinafter presented not in the order of frequency of use, nor in the order of their importance, but roughly in the chronological order in which they have made contributions to the field of child psychology.

The Questionnaire Method. The questionnaire method is so familiar as hardly to need description. An experimenter in search of data which cannot be arrived at by the use of apparatus in a laboratory, formulates, purely empirically, a series of questions calculated to yield the data which he seeks. These questions may or may not be submitted to a series of competent judges. The questions are then placed in order, usually chance order, and sent to a selected list of subjects. Each is supposed to fill in the answer accurately and truthfully and to return the questionnaire to the experimenter.

The questionnaire method is open to many criticisms. In the first place, unless the questions have been submitted to competent judges they may not yield the required data. On the contrary, the formulation of the questions may cover completely the actual meanings at which the experimenter wishes to arrive.

Again, though the list to whom the material is sent may

be excellent, only a few may reply. There are many instances of researches based on the replies of the 20 per cent who were willing to answer the questions. Where the questions refer to the sex life of youth, not only are the answers few in number, but they are often rather an attempt to "take the experimenter for a ride" than an attempt to give a true picture of the subject's experiences and emotions.

After one such questionnaire, the students confessed to the writer that they had deliberately falsified the results in order to "have fun" with the experimenter. The publication of these results would have yielded startling data, which, though not correct, would have been exciting enough to arouse considerable interest.

A third criticism is that many questionnaires require reminiscence and this has frequently been proved to be far from accurate. It is common knowledge that the disagreeable tends to be forgotten, while the pleasant is remembered, as the far-from-factual reminiscences of even trained psychologists when they report on the activities and conquests of their youth will clearly show.

As a last criticism it may be added that the questions are answered by individuals with a particular bias or biases and usually left unanswered by those who are not influenced by these biases. Under these conditions the data collected hardly yield a true picture of the area studied.

Nevertheless there are places where a questionnaire yields a more accurate picture than actual study or observation, *e.g.*, the material on imaginary playmates. An experimenter who does not know children well, or in whom they do not have sufficient confidence to initiate a discussion of their imaginary playmates, may study in vain a group of

forty to sixty children. In fact, this occurred with one of the writer's undergraduate students conducting an experiment in this field. In the group of forty there were twenty children with one or more imaginary playmates, none of which were revealed to the experimenter in her daily observations of the group. All of them had been discussed with another trained experimenter whom the children talked to and trusted. It is possible that there were other children with imaginary playmates who were too reserved to discuss these with anyone at any time.

When a questionnaire is directed at adults they rarely object to a discussion of their imaginary playmates. In a class of 160 students 90 held up their hands willingly when asked if they had had imaginary playmates in their childhood. Another twenty were willing to acknowledge that they probably had imaginary playmates, though they were not willing to discuss them before the rest of the class. A questionnaire to adults in this field would then yield more satisfactory results than observations of nursery children under controlled conditions.

Such work as Anderson's on sleep in young children is based partly on the questionnaire method. The data derived from the use of these questionnaires could not have been arrived at in any other way and is to date the most reliable material we have on the actual hours of sleep required by young children.

In general, however, it is better to use more accurate methods where these can be employed.

Observation under Controlled Conditions. Since the behavior of young children in a laboratory situation is usually not

that found in everyday play life, many activities can be studied only by the method of controlled observation.

The experimenter takes a specific activity or series of activities for the subject of his study. He either studies these during set intervals—*e.g.*, changes in behavior within successive five-minute periods or he studies an activity as a whole from its original inception to its conclusion without regard to time, or he records the total time during which the activity has been carried on. To date, the best milieu for this type of research is the nursery school. While the children who attend a nursery school are always to some extent a selected group, since the mere fact that the parents wish them to attend a nursery school selects them from the general run, they constitute in other respects excellent subjects. Their environment can be controlled within relatively definite limits. Their age, family history, and other significant material are open to the investigator for study. Such experiments as those on the free choice of toys by children of nursery-school age, the duration of attention, social attitudes, aggression, and so on, yield excellent and valid results.

There are limits to the extent to which this method can be employed, however, inasmuch as children in their homes reacting to emotional tensions and the general situations which arise in a home environment behave somewhat differently in relation to stimuli than these same children would if the same stimuli were presented in a nursery group.

For the method of observation, a highly trained experimenter is essential. It has been demonstrated many times that experimenters who are not adequately trained do not see what is actually happening any more than individuals

not trained in painting see the colors necessary to produce a desired effect.

The presence of a trained experimenter in a nursery school is accepted by both children and teachers. No change occurs in the routine and the children continue to behave as though no observer were present. The data obtained are adequate and accurate insofar as they relate to the behavior of children in a nursery school under the conditions supplied by that particular nursery school. Repeated use of the same technique by equally well-trained observers in a number of nursery schools yields data which may be generalized. It is still not applicable to the behavior of these same children in their own homes, but it is valuable for use in the prediction, interpretation, and control of nursery-school behavior. Some of the material applies more widely, *e.g.*, that on learning.

There is still a wide field which has not been explored and which is difficult to reach, *viz.*, the behavior of the individual child in his home. The case-study method, discussed later in this chapter, gives us all the material which we are likely to have from this field.

The observations of untrained parents on the behavior of their children are not to be accepted as valid, and the presence of an experimenter in a home is apt to throw the whole mechanism out of gear and to yield results entirely different from those which would have occurred if the experimenter were not present.

There is nothing new about observation as a method of gathering scientific data. An ornithology based on laboratory experiment would be a patent absurdity, though ani-

mal experimentation has yielded valuable data (see Riddle's work on pigeons).

Observation is the only method possible in such studies of the behavior of primitive peoples as those made by Mead on the Samoans,* the natives of New Guinea, and the Balinese.†

It could be employed even more frequently than it has been to date, especially for the study of pre-adolescents and adolescents. It could also be employed more frequently in the study of child conditions other than those found in the nursery school.

The Case-study Method. Many of the data which cannot be obtained through direct observation may nevertheless be obtained by the case-study method.

In such studies all the relevant data about a single child and his family must be collected if the child is to be studied accurately. These data include health record to date, intra-uterine conditions and conditions surrounding birth, developmental record including age of talking, walking, and so on, habits, problems presented by the child, complete family history of both the father and the mother, and the complete history of the siblings. The data are secured by competent psychologists, psychiatrists, social workers, and physicians, each collecting the data in his specific field. The data are then massed and the child studied against the background which he presents. This is the method commonly used in the study of behavior problems.

* Mead, Margaret, "Coming of Age in Samoa," William Morrow and Company, Inc., New York, 1928.

† Bateson, Gregory, and Margaret Mead, "Balinese Character," New York Academy of Sciences, New York, 1942.

When a large series of such cases have been collected, they may be examined for specific traits, behavior patterns, and so on. A complete picture of one hundred children who showed temper tantrums will yield both the stimuli which tend to produce tantrums and certain methods which may be used to deal with this problem. The age of onset of temper tantrums and incidence in the population at certain ages, their duration under definite sets of conditions, and other data may be arrived at in this fashion.

Such material as that presented by Freud and his followers is based solely on the case method. The psychology of motivation is founded largely on the material derived from case studies.

A combined picture arrived at by all three of the methods previously presented would give a fairly well-rounded picture, but a fourth method is necessary, *viz.*, the method of experimentation. Much that will be said in discussion of this method applies equally to the three methods previously discussed.

The Experimental Method. Since experimentation in the field of early childhood is still relatively new, it is well to set forth here the conditions for good experimentation, though some have been pointed out again and again ever since the experimental method was evolved in the 1890's.

The following would probably be agreed upon by all research students as necessary if the results of experimentation are to be declared valid.

First, the problem must be stated simply and clearly. It should be stated so clearly that anyone who reads it can know exactly upon what the experimentation is intended to

throw light. A hazy setting of the problem not only throws the results themselves into some question but also makes it relatively impossible to test the experimenters' findings under other conditions and with other experimenters.

There should be no confusion on the part of the reader as to the scope of the problem and the field within which it lies.

The areas in which the research falls should be clearly delimited. For example, some time ago a student in training in research undertook the following: "To determine the difference between two groups, one of whom received mothers' aid and the other of whom supported itself without aid." Needless to say a problem of this sort covered far too wide an area. One might undertake to determine between an experimental and a control group the difference in height and weight at the end of a certain period; the differences between a few clearly defined buying habits; the difference in the number of children in the families at the end of ten years, or an even longer period; or the differences in school progress between the children in the two groups, provided that the conditions surrounding these children were also controlled. In fact the number of problems which might be studied is too long to list in this discussion. The failure to delimit clearly the areas in which the research lies is one of the most common faults among young research workers.

Apparatus and Method. The apparatus used should be described in detail and, if possible, it should be such as can be duplicated in other laboratories. If the apparatus is not described clearly, then again other experimenters are prevented from repeating the experiment and thus giving it the one possible measure of validity.

It should also not be overly complicated or much more expensive than the material to be found from it would warrant. None should be used if the results can be obtained as accurately without it. To use expensive and complicated apparatus to obtain material already familiar to a number of professions is to offend against some of the best aspects of the law of parsimony.

The method of conducting the experiment should be given in detail and, again, clearly. Where important elements have been omitted or slurred in description, it is impossible to repeat the experiment. Science has many records of experiments of this type.

The method should be such as to throw light on the problem. Such a research, for example, as one conducted on children's reading, which gave conclusions having nothing whatever to do with reading but merely referring to the pictures at which the children looked, is a case in point.

There are a number of other points at which research may become invalid: phrasing which presupposes one answer rather than another or which covers up the true meaning; questions which may have many interpretations; or questions which produce an emotional tone that may inhibit truthful responses.

The method should be such as to ensure valid data. There are certain methods of research which are almost certain to yield data open to question, *e.g.*, the questionnaire. Unless all or almost all of the questionnaires sent out are returned and unless the data which they contain are not such as to lessen the danger of subjective interpretation to all irreducible minimums, questionnaires are useless. In

fact methods of this sort are so questionable as to make them useless except within an exceedingly limited area. As we have already pointed out, reminiscence and observations without check are, from the point of view of science, often practically useless. The methods themselves carry within them such immense possibility of error as to make the results open to question no matter how carefully the methods were used. Controlled observation by trained experimenters, if a sufficient number are engaged and if the observation is checked and rechecked, may and often does yield valid results.

Subjects. The subjects chosen should be sufficient in number, even if the group represents a sampling, to enable one to draw adequate conclusions. Twenty-five cases, no matter how well selected, if these are supposed to represent the behavior of a group of a thousand or more, is hardly a sufficient sample.

The method of sampling itself must be correct according to the best statistical procedure. It is not necessary here to point out all these conditions since they may be found in any good textbook on statistics* but a few are important enough to bear repetition.

The subjects should represent an unselected group unless the problem itself lies in a group of selected individuals, *e.g.*, college students or nursery-school children.

It must always be remembered that when the setup of the group itself is such as to make it a selected one, no general conclusions can be drawn. Much of the experimentation in the field of preschool children has remained specifically within that group attending nursery schools.

* See Garrett, H. E., "Statistics in Psychology and Education," Longmans, Green and Company, New York, 1926 and 1937, and other texts.

The fact that the child attends a nursery school makes him one of a highly selected group since the average parent is, at the present time, still far from convinced of the necessity of this type of education. It is possible to draw conclusions as to the behavior of nursery-school children if one is experimenting on a nursery-school group, but it is not permissible to draw conclusions applicable to the general run of children of this age on the basis of these nursery-school children.

The same applies to experiments conducted on college students and on individuals with the degree of Ph.D. All these represent in themselves such a highly selected group as to make them useless as a basis for making applications which are general at any point except insofar as that they are primates.

The subjects should represent a fair sampling of each age if conclusions applicable to each age are to be drawn. Standardization of several tests have been made with as few as five to twelve children at an age. This makes them useless except for those five or twelve children. At least one hundred children at each age should be included in any group.

Such experiments as Anderson's on sleep are excellent because of the number of children involved and because of the methods of selection employed.

The same subjects should go through the experiments at each age if longitudinal studies are to be made. It is obviously poor technique to test one hundred children at two and then to retest fifty of these and add to them fifty others not previously included when one draws conclusions about age three. This error in sampling has been frequently

made. The fact that it is a retest on some and a first test on others is enough to invalidate in part the results of this type of research.

All facts about the subjects pertinent to the experimentation should be on record. When the results of mental tests alone are used to draw conclusions about changes in intelligence quotients the material is per se invalid, since it has been clearly shown that changes in glandular function, severe emotional upsets, and other factors may produce a poor test record at a single sitting. No conclusion should be drawn unless a complete clinical picture is at hand. Terman (94) states that many factors of different sorts must be taken into consideration. Since the test was standardized by Terman and his colleagues, it might be well to keep these points in mind.

If control groups are to be used these must be equated in at least the following: economic status, age, sex, intelligence quotient, race, previous educational experience, health record to date, unless one of these is to be studied. In the latter case they must be equated in all the other points. It would be well also to equate the subjects in height, weight, and present general condition of health. There are a number of experiments in which all these factors must be present if the groups are to be truly equal; *e.g.*, in some of the studies on the effect of nursery schools on intelligence quotient, no attempt whatever has been made to take into consideration conditions of health or previous experience. Some experimenters have failed completely to equate in terms of such obvious essentials of pairing as the intelligence of the control group at the beginning of the experimentation and have merely indicated that because two children were equal in intelligence and were at the

same time five years old and from a family of good economic status, nursery school had no effect on the one who attended it.*

Presentation of Data. All relevant data should be presented in order to enable the reader to draw his own conclusions and in order to build up a mass of data from different centers. If all the data on learning in young children now amassed by all the Child Welfare Centers were available, we should be far clearer about the learning capacity of young children.

A number of researches have presented only the means and M.V. Still others have presented the average and S.D. and nothing further. Still others have drawn curves so poorly labeled that they cannot be read. The presentation of the data from the first to the one-hundredth percentile is usually an excellent method, but, where the data in the field are important—and what experimenter would agree that his are not?—it is well to keep on file the complete record of every individual involved in the experiment and to have this available to other experimenters.

Where possible, statistical methods should be used, since few qualitative experiments yield results which can be interpreted accurately.

The old method of writing down each word used by a single child to determine the rapidity with which his vocabulary developed and then drawing conclusions applica-

* One experimenter paired groups by the simple but completely inaccurate method of selecting the child who sat next to each of her twenty-five subjects in school. Apparently something went wrong even with this technique, for she compares an experimental group of twenty-five with a control group of forty-five. A mathematical mind would retreat in complete bafflement, but the experimenter appears to be entirely content.

ble to children in general is an excellent example of all the possible statistical inaccuracies. Where no mathematical checks can be applied, the results are always open to subjective interpretation.

General Conclusions. Conclusions should be drawn on the basis of the results of the experimentation. Conclusions which do not bear on the data are not permissible under any conditions whatsoever.

The conclusions must be such as are borne out by the data. Many experimenters have drawn conclusions on the basis of the data which proved, and neglected entirely the data which disproved, the conclusions for which they had too optimistically hoped. The problem of science is not to *prove* anything but to determine where the facts lie. Often the statement of an experimenter is sufficient to indicate that his conclusions will probably be invalid, for his problem says "to prove the relation" between such and such conditions. The fact that he has started out to prove that there is a relation is sufficient to invalidate the data, since his subjective error is always present.

The experimenter should avoid all anthropomorphic interpretations in his conclusions. Such statements as "This is the way in which the animal is thinking" are, of course, absurdities, since no one but the animal knows what he is thinking if, indeed, he thinks at all.*

* For the first presentation and discussion of methods to be used in studying children, see "Psychology of Childhood," by Naomi Norsworthy, and Mary Whitley, Chap. XVII, The Macmillan Company, New York, 1926.

INHERITANCE FROM THE NEAR ANCESTRY

Hereditary versus Environmental Factors. Those who deal with the education of children of any age are constantly faced with questions concerning the extent to which behavior is influenced by hereditary predispositions. If a child behaves as he does solely because of a physical and mental make-up inherited directly from his ancestors, then education can influence his behavior only insofar as it modifies such inherited make-up. If, on the contrary, behavior is solely the result of environment, then the educator is the sole determiner of the behavior of the children under his charge. Such a point of view would hold that even mental level is the result of the type of training and the degree of richness in the environment with which the children come in contact, particularly in the early period of their lives.

Authorities who have said that mental level is the result of environment have caused so much discussion and will have, if correct, so wide an influence on education that a special section is given to the discussion of this particular phase of the controversy between those who take the point of view that heredity predetermines capacity and the pure environmentalists.

Few hold the first point of view, the predominance of

heredity, in its extreme form. A number of recent authorities have taken the second point of view. For the most part, opinions as to the relative effects of nature and nurture lie between the extremes. Whatever the point of view in regard to the relative effects of nature and nurture held by the individual who deals with the child, it is his business to provide for that child the education indicated by the child's capacities and by the stage of development which it has reached at the time at which the education begins.

Authorities tell us that the period of most rapid growth of the brain is from infancy to five years of age. Those who hold the point of view that environment is the sole determiner contend that the environment has the greatest effect during this period of rapid growth; and this position would seem to be logical.

Biological Explanation of Variation. One of the most significant problems for educators is the possibility of infinite variation between children from the same parent stocks. No matter what point of view one holds in regard to heredity vs. environment, this variability has to be accepted as a fact. The biological explanations of such variability are relatively simple. If one goes through the family stocks to determine the exact number of ancestors which each child possesses, one finds eight great-grandparents, sixteen great-great-grandparents, and so on, the number of ancestors doubling as one goes back for each generation unless there has been intermarriage between members of the family, *e.g.*, marriage between cousins. Popenoe (67) states that if it is considered that William the Conqueror is separated from his descendants of today by twenty-four generations, any infant of British extraction has had to date 16 million ancestors. This, as Popenoe states, is

greater than the number of inhabitants in Britain and France together at the time of William the Conqueror. Some of these stocks have died out and some of their characteristics have died with them. The possible number of permutations and combinations of traits which have appeared in these ancestors and which may now appear in the present generation is, of course, literally innumerable, in spite of the fact that some branches have died out through lack of fertility or other causes.*

An examination of the behavior of the chromosomes under cell division shows clearly the way in which various permutations and combinations of traits may occur in children from the same parents. One has only to study the behavior of cells preparing for fertilization. After the genes, which carry all of the hereditary characteristics, come together in chance order, the 48 chromosomes, 24 pairs, arrange themselves in the center of the cell about to divide. As the cell splits, one of each pair, 24 in all, go to each half. This occurs in both male and female germ cells. The female germ cell has within it 24 pairs of chromosomes inherited from the maternal side and 24 pairs from the paternal side. This is also true of the male germ cell. Since the genes are arranged roughly in chance order, when the mother cell forms two daughter cells, 23 chromosomes from the maternal ancestor may go into one daughter cell and only 1 from the paternal side. These chromosomes may distribute themselves in this or any other order. The cell which will be fertilized may carry 23 chromosomes from the mother's father and 1 from the mother's mother or even 24 from the paternal side and none from the maternal.

* Popenoe also states that even though only thirty-three of the members of the band of Pilgrims landed from the Mayflower founded families, these must have literally millions of descendants.

This behavior is characteristic also of the male germ cells, which are being prepared to fertilize the ovum. The possibility of permutations and combinations among the chromosomes in the germ cells of maternal and paternal ancestors is thus almost infinite. The chance that any two children born of the same parents, even at the same time unless these be identical twins, will be exactly the same, is one in over 3 billion.

As a matter of fact, not even identical twins, triplets, and quintuplets are exactly alike, as witness the measurements of the Dionne quintuplets (5).

The possible combinations from a single reduction division of the male germ cells involved in a mating is 16,777,216. The possibility of any two children in a single family exactly resembling each other is thus mathematically too remote to come within the range of possibility, much less probability.*

Two children from the same family may have not a single chromosome in common, whereas two first cousins may have several such chromosomes in common and therefore be more nearly related in their chromosomal content than are a sister and a brother. If the parents are first cousins, the possibility of similarities is, of course, increased. The old point of view that one inherited directly the blood strain of his common ancestors has no basis in fact.

Cell reduction before fertilization eliminates that possibility at a relatively rapid rate. To give a few examples, based on mathematical calculations, of the probability of inheritance from a distinguished ancestor, the odds against

* The pertinence of this discussion of variability to the later discussion of the effect of nature vs. nurture on the intelligence level is not difficult to see.

having received even 1 chromosome from any given ancestor if he was a Revolutionary War hero are 4 to 3; if he lived at the time of John Bunyan, 10 to 1; at the time of Mary, Queen of Scots, 85 to 1, and at the time of Columbus, 680 to 1 (77). This places the searcher for ancestors whose traits he has inherited at a distinct disadvantage since he may have inherited no trace of the chromosomal content from the ancestor whom he admires (14, 53, 55, 77).

Fortunately for a few strains which have produced a number of geniuses, there is a tendency among certain types of stock to intermarry and thus to increase materially the mathematical chances of producing similar distinguished behavior. The chart of the Darwin, Galton, and Wedgwood families, presented in many texts, is a case in point.

The behavior of certain genes in human mating does, however, follow roughly a pattern which enables one to predict within limits the presence or absence of such traits as baldness and the like. The behavior of the so-called "black" genes is also more or less predictable in human matings. The combinations and permutations of genes in hybrids are predictable in accordance with the Mendelian law.

Inheritance and the Four Phases of the Child's Make-up. Before going into the study of the psychology of the preschool period, the earliest period at which education begins, it will be wise to cite such weight of opinion and such scientific evidence as we have relative to the extent to which inherited predispositions are influential in determining the four phases of the child's make-up with which we have to deal: (*a*) mental level; (*b*) special abilities and disabilities; (*c*) physical make-up, including health; and (*d*) personality.

a. Inherited Predispositions in Regard to Mental Traits. We have much scientific evidence as to the inheritance both of mental level and of special abilities and disabilities. The first point to be considered in this discussion is the extent to which the child's mental level—his position as feeble-minded, dull, average, superior, or very superior—is determined by heredity.

Brave, indeed, would be the author who attempted to give absolute information in regard to nature vs. nurture in the field of intelligence level. The results of researches giving evidence on both sides of this question are presented herewith. These are all based on the results of mental tests and deal with intelligence quotients only.

The Iowa Child Welfare Research Station takes the position that all intelligence levels are the result of environment. According to Dr. Wellman (103, 104, 105, 106, 107, 108), who holds the most extreme view so far promulgated in regard to the effect of environment on intelligence, normal children may be made feeble-minded and feeble-minded children may be made geniuses if the environments are such as to produce these amazing changes. Dr. Wellman states that "another conclusion which seems to emerge" is that children of average ability may be made feeble-minded (106).

Her results are based upon tests of children in the nursery school at the University of Iowa and upon tests of children in child-caring institutions. The experiments have been carried on over a number of years.

Children in the preschool laboratories and in the University of Iowa school were retested regularly,* twice each

* Regularly enough to make practice effects certain.

year during the fall and spring terms for those in the preschool laboratory and once each year for those in the university school. Other tests were made of children who transferred to the city school systems, but these were irregularly given. In 1932 Dr. Wellman and her staff had given approximately three thousand Binet tests, part of which were made with the 1916 revision of the Stanford-Binet scale and part with this scale supplemented by the Kuhlmann-Binet. The initial tests number 1,350 and the repeated tests 1,650. The children in the preschool laboratories were a selected group since their median I.Q. was 115. The first tests of the children were classified in Terman's groupings; *i.e.*, 90 to 109, 110 to 119, and so on. All groups showed gains when they stayed in the University of Iowa practice school.

With the number of tests constant, Dr. Wellman (103) finds an average gain of 7.8 points in intelligence quotients from fall to spring, a loss of 0.9 a point from spring to fall in 193 cases. Her statement is that attendance at nursery school, especially the Iowa Nursery School, produces a gain in intelligence quotient. In later studies, these cases were followed up, and the final conclusions are that not only does attendance at the Iowa Nursery School produce an increase in intelligence quotient but, if these children continue to attend the educational institutions provided for them by the University of Iowa, these gains are held.

Later work of Dr. Wellman and her colleagues is with children in orphanages (80, 81, 82, 83, 84, 85, 86). In 1937, Skeels and Fillmore (83) found that there was a constant downward trend in intelligence quotient among the older members of families coming to the orphanage and that

the longer these children stayed in their own homes, the lower their intelligence quotients on the average. A later study by Skeels, Updegraff, Wellman, and Williams (84) deals again with the orphanage problem. The results lead them to make the statement that continued residence in the orphanage produces feeble-mindedness in children of average ability. The behavior of six children presented to support the statement that residence in the orphanage produces feeble-mindedness in average children is worthy of note.

In the first place, none of the children tested were over five years of age at the time of the final test. Second, some of the drops occurred at a rate unknown in ordinary clinical studies, *e.g.*, the child who lost 27 points in intelligence quotient in a period of six months. These results, if taken at their face value, would lead to a change in our educational system and in our methods of child placement for adoption.

In examining these data, it is well first to point out the criticisms made by McNemar* (47). In the first place, in the setup of the Iowa experiments regarding the effect of preschool experiments in intelligence quotient

> . . . it was not possible to control more than two or three of the following variables at a time: (1) age, (2) initial intelligence, (3) orphanage residence, (4) actual number of days of school attendance, (5) days of residence between tests or retest intervals, (6) various examiners, (7) Kuhlmann-Binet or Stanford-Binet, (9) possible practice effects, (8) unintentional coaching in pre-school on material similar to many items in the tests used, and (10) differences in rapport in testing.

The conditions of sampling have been violated, since the fundamental conditions for sampling are (47)

* Many of the criticisms which follow were also made in a paper presented to the Cincinnati Psychological Association by Dr. Clara Kuenzel in 1937.

> . . . that each unit or individual in the universe being sampled must have an equal chance of being included in the sample, and that the drawing of one unit or individual must in no way affect the drawing of any other unit or individual. This latter condition can be stated differently: The drawing of each unit or individual must be independent of the drawing of any other unit or individual. These two conditions are the basic assumptions for all ordinary standard error formulas.

This latter statistical error could have been avoided by use of proper methods. The initial tests themselves seem to have involved peculiarities either in being recorded or in being written up. Again to quote McNemar, "Nothing is said in the report about shyness, negativism, distractibility, or general cooperativeness of the children during the testing" (47). McNemar further quotes a series of interesting comments made by the authors on the attitudes and reactions of the children tested as follows: "The language of the children was in the great majority of cases either entirely or practically unintelligible"; "any constructive conversation seemed out of the question"; the children were "not accustomed to listening to the words of adults"; "the attitude toward adults was a strange mixture of defiance, wish for affection, and desire for attention"; there existed "a feeling of the individual against the world, expecting no quarter and giving none"; reaction to strangers was "the same [as] to wax figures"; there was "an almost invariable negative response to anything which the child could possibly interpret as potential coercion" and a "highly emotional response to unwelcome requests"; the children were "full of suspicion and mistrust" and "seldom in the frame of emotion or mind to face a situation"; they showed "lack of confidence in adults" and "generally violent and moblike reactions to new situations."

As McNemar so well states in calling our attention to

the procedure at the initial test, the initial tests themselves are open to question as to validity.*

Anderson (1) has made equally significant criticisms of the statistical procedures used by these investigators. The results of other studies do not bear out the findings made by Dr. Wellman and her colleagues except to point out that tests of children below the age of five give relatively unreliable results. Dr. Goodenough (26) cites the case of an infant who made an I.Q. of 88 in an initial test and who, six months later, made one of 168.

Such authors as Neff (54), Bayley and Jones (3), Terman (94, 95), and Schott (78) have stated that the intelligence quotient is affected very little by environment.

There are certain factors which the Iowa research fails to take into account, such as improvement in health, the presence or absence of certain glandular secretions, and other changes of a clinical nature.

In spite of the number of criticisms of the work of Wellman and her colleagues, their researches have made a contribution to psychological thinking. Any concepts which have been held for some time are apt to be accepted as universal truths until their accuracy is questioned. If the work of Wellman and her colleagues has done no more than to initiate a series of investigations by other scientists, it would still be of value. It not only has done this, but it has forced psychologists to think through their

* As an additional criticism, McNemar states that "a critical study of the statistical jugglery reveals that differences in rapport need only be invoked to explain slight, statistically insignificant findings. And finally, the authors are guilty of continually playing up unreliable differences and ignoring not only alternative explanations, but also those parts of their data which do not fit with the environmental hypothesis."

beliefs in regard to the finality of a single test result. It also has emphasized the work on the effect of environment on factors other than intelligence, *e.g.*, personality and health both physical and mental. There are a number of experiments on the effect of nursery education on personality, school progress, health, and the like. These have agreed in their results, *viz.*, that children who have had nursery-school experience for one year or more show better personality, better health, and better school adjustment than do nonnursery children of the same age, sex, environment, and mental health.

Final conclusions as to the possibility of raising intelligence by environmental conditions cannot be drawn until a long-continued experiment, organized as suggested by Dr. Goodenough (26), has been carried on in a number of environments and with a number of races.

We have much evidence from other experimentors, who have not been concerned with the argument in regard to the importance or nonimportance of nursery education. The statistics from Vineland indicate that no true feebleminded case has, in spite of the best service given over long periods of years, been made average.

We might also point to the results of studies of the Dionne quintuplets (5, 6). When the quintuplets were first made wards of the government and their care ensured, they became significant in the argument of nature vs. nurture. These children have not only had every possible care physically, but psychologists, geneticists, and pediatricians of international reputation have been called in in consultation about them. If it were possible that children of less than average mentality could be made into geniuses by

good nursery-school procedure, these children should have reached the highest known intelligence quotient and by the age of five, the final age at which many of Dr. Wellman's cases were tested.

The results of tests of the Dionnes justify no such conclusions. None of the quintuplets had so far reached an I.Q. of as much as 100 (5).

Whatever explanation one advances, the facts are as presented by Blatz.* Had these children now shown an I.Q. of 110 or better, we might have pointed with intense interest to the possible effect that environment had had on their development. Unless at maturity they show I.Q.'s better than average, we must question again the effect of environment, at least in making average or under-average children into geniuses.

Freeman (20, 21) in his researches on the effect of placing foster children in good homes indicated that the homes might play a significant part in raising intelligence quotients. These results lately have been questioned by Leahy (40, 41, 42).

Certain older studies may be cited to indicate the part, if any, played by environment.

Woods's (111) study of royal families shows the extent to which greatness in the royal families of Europe was

* Blatz states that the five children began with a serious handicap inasmuch as they were premature by two months. Moreover, all multiple births appear to show retardation in language development as compared with children of single births. The quintuplets were not in good health during the first few months of life and had to be cared for more carefully than the average child of like age.

dependent upon the racial stocks from which they came. According to this investigation, when 671 members of royal families in Europe were each given ratings, on a scale from 1 to 10—10 representing especially high ability or genius, and 1 extremely low ability—it was found that the most eminent persons were grouped about four stocks or families, *viz.*, the families of Frederick the Great, Queen Isabella of Spain, Gustavus Adolphus of Sweden, and William the Silent of Holland; that most persons of low ability were grouped about certain families in Russia and Spain; and that persons with median ratings (4 to 7) centered about some six royal families, including the houses of Hanover, Saxe-Coburg-Gotha, Reuss, Mecklenburg, the Austrian branch of the Hapsburg family, Holstein, Denmark, Saxony, and modern Portugal. This variation in the groups of the families is indicative of the tendency for eminent ability to be transmitted, inasmuch as there can hardly be doubt that the environment and educational opportunities which were furnished all members of all the royal families or stocks were as good as could be provided by their respective countries.

As an example of studies of genius and intelligence levels, one may take such researches as those of Galton (22), in which he found that 977 eminent men, each of whom was the most eminent among 4,000 persons, possessed a total of 535 eminent relatives, whereas 977 ordinary men, selected at random from the population, would have had only four such eminent relatives.

Data on the other side of the question, *i.e.*, the transmission of low mentality, can be found in any of the numerous studies of the inheritance of feeble-mindedness; such,

e.g., as the studies of the Hill Folk, the Nams, and the Jukes.*

These are only a few of the studies which give evidence as to the transmission of grades of ability, but in all the studies cited there was evidence that individuals of average intelligence appeared both in the stocks which produced eminent men and in the stocks which produced defectives.

A further field of investigation from which evidence may be cited is the series of investigations of Terman and others as to the difference in intelligence between the different social-status groups. Pressey and Ralston (69) found the percentages among 548 children from different social-status groups scoring above the median to be as follows:

Occupational Group	Percentage above Median
Professional	85
Executive	68
Artisan	41
Laborer	39

Bridges and Coler (9) found a similar situation in 300 children, on whom the Yerkes-Bridges Point Scale was used:

Occupational Group	Average C.M.A.
Professional	1.42
Traveling salesmen	1.26
Proprietors, etc	1.21
Skilled	1.12
Unskilled	0.83

Similar results were also obtained by Book (7).

* The conclusions drawn from such studies as the family of the Nams and the Hill Folk appear to be somewhat more open to question on the basis of the part played by environment than are the studies of the transmission of eminent ability.

More recently we have the work of Leahy and Burks, a table from whose researches is included herewith as modified by Loevinger.

TABLE I.—CORRELATIONS BETWEEN CHILD'S IQ AND FACTORS IN THE HOME*

Factor	Foster children						Control children			
	Freeman		Burks		Leahy		Burks		Leahy	
	N	*r*	*N*	*r*	*N*	*r*	*N*	*r*	*N*	*r*
Home rating	401	.48	206	.21	194	.19	104	.42	194	.53
Cultural index			186	.25	194	.21	101	.44	194	.51
Father's occupation	394	.37			194	.12			194	.45
Economic status			181	.23	194	.15	99	.24	194	.37
Father's education			173	.01	193	.16	102	.27	193	.48
Mother's education			194	.17	192	.21	103	.27	194	.50
Mid-parent education		.42			193	.20			194	.54
Father's intelligence	180	.37	178	.07	178	.15	100	.45	175	.51
Mother's intelligence	255	.28	204	.19	186	.20	105	.46	191	.51
Mid-parent intelligence	169	.39	174	.20	177	.18	100	.52	173	.60
Father's vocabulary	152	.27	181	.13	177	.22	101	.47	168	.47
Mother's vocabulary	224	.37	202	.23	185	.20	104	.43	190	.49
Mid-parent vocabulary	146	.36			174	.24			164	.56

* Probable errors are all between .03 and .05.
Taken from Freeman (20), Burks (10), and Leahy (40, 41), modified by Loevinger (46).

Studies of twins may also throw light on this problem. These studies deal with (*a*) resemblances at birth, (*b*) resemblances between identical twins and fraternal twins at birth, (*c*) resemblances between known identical twins reared in the same environment, (*d*) resemblances between identical twins reared in different environments. One of the oldest of these is Galton's (22) studies. According to his results, twins remain very similar throughout life if similar at the outset. If dissimilar at birth, they remain different throughout life in spite of similar environments.

In visual handicaps there is much more similarity between twins than between siblings and this is true of other handicaps (8, 27, 28, 39, 74). Identical twins show very close resemblances in palm-print and fingerprint material and in general physical measurements (56, 57, 58, 59, 60). The only exceptions are those cases in which there is birth injury or those in which physical abnormality has developed (33, 43, 45).

In the case of schizophrenia, monozygotic twins show close resemblances. They are also similar in their tendency to develop lack of resistance to epilepsy and tuberculosis (19, 43, 74) and other diseases (39, 66, 101). There appears to be no greater resemblance between fraternal twins than there is between siblings.

Studies of twins reared apart yield interesting material on the effect of environment on both personality and intelligence level. Newman, Freeman, and Holzinger (61) have conducted the largest series of researches in this field. The general results of their studies are that twins who are reared apart show much wider differences on the average than do identical twins reared in the same environment. These differences are in terms of qualities of personality, in intelligence, and even in physical make-up. A number of their cases, however, showed little dissimilarity despite the fact that their environments were widely dissimilar. Sontag and Nelson (89), Wilson and Jones (110), and Orel (62) have pointed out that physical differences may increase with increasing age, and this has also been demonstrated by Carter (11).*

* Carter (11) points out also that the diagnosis of monozygosity can be made much more easily during school age than at maturity or in later life.

Hilgard (29), Jones (36), and Strayer (93) show that factors such as are produced by maturation are of greater importance than specific training in the determination of resemblances between twins during the period of rapid growth.

Richardson (73) points out the fact that fraternal twins show more resemblance when they are tested at the same age than when they are tested two years apart. Her general conclusions are that twins show such likenesses in intelligence because they "coexist in time."

Newman, Freeman, and Holzinger (61) have shown that where fraternal twins are reared in the same environment they show wider differences at maturity than in the early years, but monozygotic twins show almost the same difference of resemblance at maturity as they did during early life.

Wilson (109) has shown that fraternal twins are more apt to differ in disease history than do monozygotic twins.

There have been many other studies on the relation between identical and fraternal twins reared in the same and in different environments.

Further studies of this sort might well yield additional significant data on the effect of environment vs. heredity, since such changes as appear to take place in intellectual level between identical twins who appear to be widely dissimilar may have been present at birth.* Koch (37)

* Carter (11) cites a number of studies in which there was wide variation in identical twins as to both physical and mental capacities. It is only necessary to read the literature on identical twins to have one's mind disabused completely of the idea that they are born exactly similar in intelligence. Whatever produces the degree of variation, it is wide; *e.g.*, see the report of Koch cited above.

reports wide differences in intelligence between Siamese twins.

Ley (45) reports a case in which the difference between the intelligence quotients of identical twins reared together was 18 points. In almost no cases have identical twins showed the same intelligence quotient, though many have been tested in infancy. Carter (11) states that the correlation between intelligence quotients in identical twins is usually about .85. Between fraternal twins, the coefficient is usually about +.55.

To summarize, the general results of studies on twins indicate that, on the average, identical twins reared in the same environment show more similarities in behavior than do fraternal twins reared in the same environment. The question of the effect of rearing identical twins in different environments is today still unsettled.

The general conclusions which may be drawn are as follows: All authors agree in assigning a higher median intelligence level to children of superior social-status groups than to children of average social-status groups and a higher median intelligence level to children of average social-status groups than to children of inferior social-status groups. There are, however, wide variations of ability in all groups and considerable overlapping. The data point to the conclusion that the median intelligence levels of such groups differ from higher social-status groups to lower, but they do not point to a uniform grade of ability in any one group.

Three conclusions may be drawn from such studies as the ones cited:

1. Grades of ability tend to run in families. Certain stocks tend to produce men of eminence in larger proportion than is the average for the population, while other stocks tend to produce a large proportion of defectives and criminals.

2. Though the tendency to grades of ability appears to be transmitted, such grades of ability do not appear equally in all the descendants of any stock. Persons of average ability appear in stocks which produce eminent men, and normal individuals appear in stocks which produce persons of low mentality and persons with criminal tendencies.

3. Such data as we have at present indicate that environment does not play a very significant part in changing mental level, but an intelligence quotient itself is not the fixed quantity which its extreme proponents have held it to be. According to our best information, the chances that an intelligence quotient will change during the preschool period amount to a practical certainty (1). After the preschool period, *i.e.*, from five years of age on, the chances appear to be one in two that the quotient will change as much as 5 points. The chances are one in five that a child will show changes in intelligence quotient of as much as 10 points. The chances are better than two in one hundred that the change may be as much as 20 points (26, 94).

b. Special Abilities and Disabilities. Since special abilities and disabilities may occur irrespective of mental level, we have also to deal with the problem of whether these are also inherited. This may be determined more accurately by correlation between special capacities as found in children and in their parents and by the perhaps less scientific but nevertheless significant method of going back through the

heredity of individuals now known to possess special capacities, such as musical talent.

Scheinfeld (77) reports his research on the presence of individuals with musical talent in such as the Toscanini family. He comes to the general conclusion that neither a single dominant gene nor one pair of recessive genes produces the talent. Thirty per cent of the offspring of individuals of outstanding musical ability were apparently without talent. He postulates the presence of two dominant musical talent genes and later qualifies this with a statement that musical talent is probably the result of a number of genes "acting together." However, there appears to be no question that his tables indicate heredity as a determining factor. The studies which involve correlation show all the way from "present but low" to those which are undoubtedly "high."

The studies which have been made as to improvements in function in individuals with difference in ability at the outset of the training period are of general interest in interpreting the role of education vs. hereditary predispositions. In the case of all the experiments cited, individuals who appear superior at the beginning of the training period continue to hold their superiority, and even, in many cases, to increase their lead, over learners who were poor at the beginning. Though the poor learners receive exactly the same amount of training under exactly the same conditions, training appears to increase the difference between those good and poor at the outset, rather than to diminish it. Reed's (72) conclusion in this respect will be discussed in a later section, but it may be stated here that in none of his researches does it appear that inferior individuals became superior.

The following tables, cited from Starch and from Thorndike, are illustrative of the tendency for training to increase the difference between individuals between whom there is a difference in ability in a function at the outset of training.

TABLE II*

	Number of examples in first ten minutes	Number of examples in last ten minutes	Gain in number of examples	Per cent gain
Three best persons.....	39	84	45	115
Three poorest persons..	25	51	26	104

* STARCH, DANIEL, "Educational Psychology," p. 88, The Macmillan Company, New York.

TABLE III.—AVERAGE NUMBER OF LETTERS TRANSCRIBED*

	First five minutes	Last five minutes	Gain
Initial highest five persons...............	139	310	171
Initial lowest five persons..	100	239	139

* STARCH, DANIEL, "Educational Psychology," p. 89, The Macmillan Company, New York.

As further proof of the effects of training on inherited capacities, we have Galton's study on twins (22).

According to the results of his study, twins remain very similar throughout life if similar at the outset, but, if dissimilar at birth, they remain different through life in spite of similar environments. According to Thorndike, twins show close resemblance in certain capacities, indicating that such capacities tend to run in families. Older twins, however, showed no closer resemblance than younger

TABLE IV.—THE EFFECT OF EQUAL AMOUNTS OF PRACTICE UPON INDIVIDUAL DIFFERENCES IN COLUMN ADDITION OF ONE-PLACE NUMBERS*

	Average number of additions per four minutes, corrected for errors			Average time spent in practice from mid-point of first test to mid-point of last test, in minutes
	First test	Last test	Gain	
Initially highest six individuals	297	437	140	40
Initially next highest six individuals	234	345	111	49
Initially lowest seven individuals	167 −	220 +	54	46

* Taken from Thorndike (98).

twins in a series of tests of these capacities (97), though similar environments should have made them grow more and more alike as they grew older. The following table is given by Thorndike (97) in support of his conclusion:

TABLE V.—THE RESEMBLANCE OF YOUNG AND OLD TWINS COMPARED

	Twins, nine to eleven	Twins, twelve to fourteen
1. The A test	.66	.73
2. The a-t and r-e tests	.81	.62
3. Misspelled word test	.76	.74
4. Addition	.90	.54
5. Multiplication	.91	.69
6. Opposites	.96	.88
Averages	.83	.70

In the field of inheritance of special abilities, we have good evidence that certain abilities tend to run in families;

e.g., there is a fairly high correlation between the abilities of brothers and sisters in some school subjects. Speed of writing shows a correlation of .72 and ability in reading, a correlation of .64, according to Starch (91). When one comes to investigation of special ability in studies among siblings in universities, one finds again a fairly high correlation; general scholarship in all subjects show a correlation of .69; in English .64; in language .63 (16). Other studies which bear on this point might be cited to prove that there is a strong tendency for special abilities and disabilities to be inherited.*

The work of Homer B. Reed (72) indicates that there is some tendency for differences between individuals differing in capacity to be lessened by intensive training. There is, however, in his work no indication that cases at the low end of the distribution were made average or that very superior individuals decreased their lead in individual capacities to such an extent that they approached average behavior. Longer periods of training or more intensive training is necessary if the very dull are to approach school standards necessary for passing grades, while only brief periods of training are necessary for the very superior child. Complete absence of an ability, such as the ability to perceive red and green in color blindness, cannot be obviated through any amount of education. The major changes which he points out are clustered around the average.

Education does improve special abilities, but the improvement is relative. A person with median ability in arithmetic does continue to add, subtract, multiply, and

* The correlation coefficients vary in magnitude for different abilities but all the correlations appear to be positive.

divide with greater speed and greater accuracy as training proceeds, but he does not equal or exceed an individual with more capacity at the outset whose training has been equal to his own.

To summarize, it would appear that the following conclusions can be drawn as to the inheritance of mental traits:

1. Grades of ability appear to be inherited, but not to the same degree by all the descendants of a stock. Children from highly intelligent parents tend to be intelligent also, but one cannot predict the intelligence of the children of a family accurately even though the intelligence level of the parents is known.

2. Special abilities also appear to be transmitted, but, here again, the degree to which these will appear cannot be predicted from the degree to which they have appeared in the parent stock.

Since it will be agreed that prediction is impossible, every child should have a complete psychological examination as early as accurate measurements can be made, in order to determine his mental level and to govern his training accordingly. Giving the same education to each child is not giving equal opportunity to each child. It is just as much the right of the dull or defective child to have the type of education and training that suits him, as it is the right of the average or of the superior child to have the type of education and training that will make for his best development. Many behavior difficulties have their origin in the strain which arises when dull children are forced to try to attain standards far beyond them. On the other hand, bad habits of work and personality difficulties often come

from keeping a superior child in a group which he far excels in mental level.

In spite of the fact that the child's intelligence level and his special abilities appear to be something with which he comes into the world, the problem for educators still remains. In the first place, the feeble-minded child can be trained to the limit of his capacity; and in the second place, the more highly intelligent child reaches the limit of his ability only after a long period of training. Moreover, the line of development which a superior child will follow is almost wholly the result of the facilities which his immediate environment offers and of the nature of the civilization into which he is born. To quote from Starch (90):

> A Newton born among Australian bushmen would no doubt have become a remarkable bushman, but never a world-renowned scientist. . . . A Newton and an ordinary bushman born and reared among bushmen would probably be superior and ordinary bushman respectively. . . . A Newton born in a modern civilized community would have greater and different stimuli than one born in an ancient or uncivilized community. His ultimate eminence would be determined by his environment.

Similarly, a child may have a sense of rhythm and great muscular control, but he does not learn to dance unless some instruction is given. Before instruction, no child can read; with instruction almost any child, except those of the lowest degree of feeble-mindedness, can learn to read to some extent. The educator has, as his problem, the determination of the mental level and the special abilities and disabilities of every child, with a view to adapting the education of that child to the special needs which his individual case demands.

c. *Inherited Predispositions in Regard to Health.* In discussing the subject of inherited predispositions to health,

it must be kept in mind that much of what the baby comes into the world with as health conditions may be the result of some prenatal influence, rather than the result of inherited tendencies. According to Rasmussen, the mother may harm the health of the child by infection with some social disease, by overexertion on her part, or by dissipation and other abnormal modes of life (70). The employment of others who work with such substances as lead sometimes is highly injurious to their children. There seems to be some evidence that endocrine imbalance in the mother may produce abnormalities in the child. Recent authorities place great stress upon the effect of the nutritive conditions during pregnancy on later health (76).

There is fairly definite evidence that tendencies to certain diseases are hereditary. Hartman and Stumpf have pointed out the fact that in cases of schizophrenia there is a similarity even in symptoms which identical twins display. Identical twins are also alike in the tendency to have tuberculosis (17, 43, 77) and diabetes (38, 101).

These similarities hold true also for feeble-mindedness in identical twins (75, 87, 88) and are even true of the general health status and the number and degree of severity of the communicable diseases in early childhood (43, 109). This would indicate that there were hereditary predispositions toward certain diseases, though the environmentalists might argue that the identical twins were exposed to exactly the same conditions and, therefore, developed the same diseases.

Inheritance of the genes which predispose toward certain diseases, is, however, relatively clear. While no single parent can pass on genes which produce rheumatic fever,

diabetes, certain kidney troubles, tumor of the eye, because at least two recessive genes are required, it is, nevertheless, true that when these genes or others which predispose toward conditions which we have not listed are present, the diseases tend to follow.

There is a long list of these so-called "black" genes, ranging all the way from those which predispose to diseases of the skin through cleft palate and harelip, defective tooth enamel and certain types of cancer (77). One of the most, if not the most, serious of these are the genes which carry Huntington's chorea, with progressive mental deterioration in middle life (77). A single dominant gene is all that appears to be necessary in this case. Since it is certain that predispositions toward a few types of diseases are inherited and that certain abnormalities such as hemophilia and some of the brain and nerve diseases appear to be inherited directly, a study of the heredity of individuals about to marry might well be of value in preventing the development of these diseases in their children.

Huntington's chorea might be eliminated in a single generation if care were taken in mating.

On the whole, the outlook for the prevention of, or delay in the time of onset of, most diseases is under our control, whether or not they may be produced by hereditary factors. Adequate health conditions for the individual from the earliest stages of intrauterine development through adolescence are essential.

Probably the most important period for setting up those conditions which predispose toward good health are the intrauterine period, the birth process itself, and the first six years of life. Most authorities are agreed that short of

birth injury or injury during the intrauterine period, good health conditions during the first six years of life can compensate for hereditary predispositions.

Gesell (23) has pointed out that the preschool period is the most significant from the point of view of resistance to the children's diseases, since resistance in this period is exceedingly low. He has also pointed out the susceptibility of the infant to accidents. Accidents in general appear to be three to five times more common before the age of six as in any five-year period thereafter.

Dentists are universally agreed that this is the period for developing resistance to dental decay not only in the baby teeth but in the permanent teeth as well. Since the tooth buds are already developing during the intrauterine period and are getting ready to erupt some time after the preschool period, this statement is undoubtedly true. Recent work has indicated that tooth structure characterized as "soft" may be built up during the first five years of life into relatively resistant enamel, which will not again tend to become soft except under unusual physical strain. Malnutrition occurs in 27 per cent of preschool children and this malnutrition tends to leave its traces in the bony structure for many years thereafter, if not permanently. Rickets is essentially a disorder of the preschool period.

The death rate from birth to six years of age is materially higher than the death rate during any five-year period after the sixth birthday.*

* "A knowledge of the incidence of the more important morbid processes and of the major causes of death in childhood leads to an understanding of the chief problems which confront the physician who cares for children. It is difficult to obtain reliable data concerning the actual total incidence of illness. *Available information suggests that children under five years suffer on the*

Lowered resistance, which can be traced to hereditary predispositions, may be built up during the preschool period to such an extent that the individual never develops such diseases as tuberculosis. Malnutrition during the intrauterine period may be largely compensated for by proper care before school age. Premature birth, which is for a few months definitely a handicap, may again be so compensated for by adequate care and education during the first five years of life that no trace remains; in fact, such retardation as premature birth tends to produce may have disappeared completely by the second year of life.

By this we do not mean that birth injuries may be compensated for since many of these appear to produce lasting injuries. Doll, for example, states that 9 per cent of the

---

average nearly twice as many illnesses per year as do children in their teens. About one-half of the illnesses of childhood are apparently due to infection of the respiratory system. The contagious diseases of childhood and digestive disorders together account for at least another quarter of all illnesses.

"Owing to the very limited number of diseases which are reportable and the rather casual compliance with the regulations even in these instances, much more reliable information can usually be obtained from death rates than from reports of the incidence of disease. This also makes fatality rates much less reliable than mortality rates. Statistical compilations of mortality rates show in a striking manner the great difference in total rates and in prominent causes at different ages; and demonstrates that sex, race, economic status, geographic location and many other factors materially influence these rates.

"More babies die during the first two weeks of life than during the remaining fifty weeks of the first year: and more die during these fifty weeks than during the next four years. The death *rate is lower in the age period* 5–9 *years inclusive than* in the years under five, and it is *still lower in the years* 10–15; lower *in fact than at any other time in life.* New problems which arise during adolescence cause a *considerable increase in mortality* during the 15–19 *years period.*" Brennemann, Joseph, M.D. "Practice of Pediatrics," Vol. I, Chap. XI. pp. 8–12, W. F. Prior Co., Inc., 1940.

population of defectives in Vineland may be traced directly to injuries received during the birth.

No factor is more important in preventing the onset of illnesses of various sorts than proper habits of health and hygiene. No period is more important for setting up these habits than is the period from infancy to six years of age. The whole range of bedroom and bathroom habits must be set up by kindergarten age if the child's health is to be normal and if his attention is to be freed from his physical self sufficiently to enable him to acquire the material which the school presents. If he has not acquired toilet habits, habits of sleep and rest, and habits of eating which ensure that he will eat correct foods in adequate amounts, he will function below par, be more prone to disease, and be less able to attend to and react normally in both home and school situations. None of the sets of habits listed can be acquired easily after school age. In many cases they are acquired only after tremendous effort and struggle on the part of teacher, parent, and child; in many other cases they are never acquired, and the child goes through life with a severe handicap.

Whatever the cause, the poorly nourished, sickly infant has less chance of developing into a normal, balanced individual on the side of personality than has the well baby; so it is of the utmost importance that such tendencies to ill-health, whether they be inherited or acquired by the child during the period of pregnancy, should be dealt with at once. Tendencies to endocrine imbalance, such as too little or too much thyroid, and tendencies to low resistance to disease seem to be exceedingly amenable to proper treatment if the treatment is begun early enough. Stock in which tuberculosis has been prevalent for generations may yet

show in their offspring no presence of the disease, if the children are kept under hygienic conditions during early childhood and youth. Similarly, in some cases, feeding a subject thyroid to take the place of that not secreted by the thyroid gland, and in other cases iodine medication, seem to produce normal children where, from previous experience, some degree of abnormality might have been expected to result had not treatment been instituted.

Many superstitions are current in regard to the extent to which children's development may be influenced by prenatal conditions. Authorities tell us that the mental attitude of the mother and the things of which she thinks during the period of pregnancy have no effect on the child except as the mother's mental attitude is reflected in her physical condition. The nutrition of the fetus appears to be influenced by the diet and by the health condition of the mother. Prenatal influence resolves itself, therefore, into the effect of the condition of the mother on the nutrition and therefore on the health of the child during the prenatal period. No shock or fright to the mother during pregnancy, unless some actual injury results, has any effect upon the mental condition, character, or personality of the child. Since health conditions are of such importance, it is essential that the mother have the best of health care during the period of pregnancy.

Breast feeding seems to have some influence on both the health and the later behavior of the child. In this connection Rasmussen (70) cites the fact that in an investigation made in Dresden,

. . . the character "very good" was, among 1,075 children, received to a larger percentage by those who had been nursed for a long period, and, conversely, the character "unsatisfactory" or "bad" was relatively

more frequent the shorter the period of nursing had been and that an examination of 6,744 men of twenty, from Thuringia and Saxony, showed that the percentage fit for military service was greater the longer they had been nursed as infants.

The results of these investigations do not point to the fact that all children who are nursed a short period would receive the character "unsatisfactory" or "bad," but only that a larger proportion of such children are so designated as compared with the children who were nursed over a long period. Individual cases show no such difference. The writer believes that a proportion of the difference between individuals nursed for a long as against those nursed for a short period can be traced to differences in environmental conditions.

Inherited predispositions to health conditions appear to be modifiable by the treatment which the child receives and, therefore, constitute a problem to be dealt with by physicians and all others who work for the welfare of children. A thorough physical examination at regular intervals is, of course, necessary, inasmuch as in this field, as in others, preventive work is of far more value than work instituted after poor health conditions have been set up.

When it comes to the matter of the inheritance of physical characteristics, such as eye and hair color, the shape of the head and the face, the tendency to be tall or short or average in height, and so on, the case is somewhat different. The first four characteristics are almost nonmodifiable. The last is modifiable only to some slight degree. Rand *et al.** found that nutrition and other health conditions which were provided by the nursery school tended to make the children of the Merrill-Palmer School, at least,

* Rand, Winifred, Mary E. Sweeny, and E. Lee Vincent, "Growth and Development of the Young Child," W. B. Saunders Company, Philadelphia, 1934.

rate above children not in such schools, both in rapidity of growth and in weight for age and height. The statistics published in the report of the Japanese Educational Association of America show that, where the Japanese children have been born in the United States, both boys and girls are taller and weigh more than children of corresponding ages brought up under Japanese conditions. Many authorities state that a similar increase in the height and weight occurs in the case of the children of Russian Jews who have become Americanized. These children are frequently four or five inches taller than their parents.

These findings indicate that height and weight may be modified by environmental conditions, but, in spite of the fact that average height and weight appeared to increase with Rand's group, and in the case of the Japanese and Russian group, individual differences were still apparent in all of these groups. Some children increased in height much more slowly than did others. Probably a curve showing the distribution of heights in the Japanese and Russian Americanized groups would still take the form of the normal distribution curve. The tendency to grow at different rates appears to be largely a matter of the race and of the parent stock from which a child comes, but environment does seem to increase or decrease height within the limits set by race and stock.

Interpretation of whether a child is growing at the expected rate can be made only in terms of the rate of growth which has preceded the period studied, plus a complete account of the factors which have influenced that rate of growth. Growth curves which represent the average rate of growth for a group of children do not necessarily represent the rate of growth of any individual within that group.

Anatomical age, *i.e.*, age measured in terms of eruptions of the teeth and the stage of ossification which the bones have reached, also appears to be a matter of individual variation. The anatomical age of a child is not necessarily the same as his chronological age, nor can it be predicted from his size and weight. A true picture of the physical status of any child would include a record of a thorough physical examination with an enumeration of any physical defects which were present, measurements of his weight and height as compared with those of children of his age, and as compared with the expected rate of growth and increase in weight, and roentgenograms showing his anatomical age. These things should be as much a matter of record as his mental level and such of his special abilities and disabilities as can be measured in other than health fields. A large part of the work which is done with children under school age should be in the correction of physical defects and disabilities, and in providing such health conditions as will lay a foundation for future resistance to disease.

d. Inherited Predispositions in Regard to Personality. There is very little evidence, based on scientific investigation, as to the extent to which tendencies to personality are inherited. If one goes back to the theory of the distribution curve, one may assume that tendencies to develop traits of personality are distributed in the form of a normal distribution curve just as traits of personality are so distributed in unselected groups of older children and adults.

The following description, paraphrased from Gates's* text, gives in simple form the way in which traits appear to

* Gates, Arthur, "Psychology for Student of Education," The MacMillan Company, New York, 1936.

be distributed: If one were to cut off the extremes of a curve so that the remainder represented 99.63 per cent, and then to divide the base line of such a curve into five parts of equal size, one would find that in the area on the extreme left 3 per cent of the cases would fall, in the next area 22 per cent, in the center area 50 per cent, in the next area 22 per cent, and in the last area 3 per cent. If one were to take, for example, the distribution of the tendency to emotional stability and distribute it on the basis of such a curve, one would see that approximately 3 per cent of the total group would have a very strong predisposition to emotional stability, 22 per cent would be more stable than average, 50 per cent would have a degree of stability which would range around a point which we might call average, 22 per cent would have less than average stability, and 3 per cent would have a strong predisposition to emotional instability. It does appear to be true that some children are born with an extremely strong tendency to emotional disturbances; others seem to have a high degree of resistance to stimuli which produce emotional disturbances; and still others appear to be disturbed by few conditions. The same environment acting on all five degrees of stability would probably produce highly different results. Children of all five grades would probably tend to become less stable if placed in an environment which predisposed to lack of emotional control, but a child who belonged at the lowest extreme of the distribution curve would probably far outrank in instability a child who originally belonged in the average group. A greater amount of skill and a longer period of training would be necessary to produce a normal amount of emotional control in the child from the lower extreme than would be required to produce such an amount of control in a child better endowed originally.

It must not be assumed that in this, or in any other, tendency there is an approximate division into five grades between which solid lines may be drawn. Actually there are fine gradations among the individuals who compose any group. If one were to take 100 such individuals and arrange them in order in regard to the possession of any trait, one would find that the actual difference between the hundredth and the ninety-ninth would be slight, as would the difference between the ninety-ninth and ninety-eighth. The curve as discussed supplies a basis for drawing certain conclusions, but by our discussion it is not meant that any statistical or other device can separate people into groups which will differ widely from each other at any point at which a dividing line were drawn on the curve. The top individual in the group of those somewhat above average would approximate, but not quite reach in degree of possession of any trait, the lowest individual in the top 3 per cent. A similar situation would probably be true in regard to the distribution of tendencies to have others of those traits which go to make up personality.

Personality appears to be so enormously modifiable by the health condition of the child, and the treatment which he receives in the first two or three years of his life, that it is difficult to determine in the child of two or three or more just how much any one character trait is the result of an inherited tendency, and just how much it is the result of the influences to which he is being subjected.* Such things as sullenness, temper tantrums, unwholesome fears, and so

* There is some evidence from the study of identical twins that their personalities were changed very little though they were in very dissimilar environments. One of Freeman's (20) cases was reared on a farm while the other remained in a city environment but both children showed remarkable similarities in personality.

on, can be shown so clearly to be the result of the experience of the child that one is led to take the position that, whereas a child may inherit the tendency to emotional imbalance from his parents, by the time he reaches the age of two or three he may be either well balanced or a neurotic, depending upon the extent to which control has been taught. The difference between individual children seems to resolve itself into the fact that, with children possessing at birth a greater tendency to emotional instability, and other asocial traits, more time, more effort, and greater ingenuity are needed if the child is to approximate normal stability; and that though a child possesses emotional stability and other good tendencies at birth, these may be destroyed by wrong treatment. For example, he may become emotionally unstable if his every whim is obeyed, if his crying brings an immediate rush of adults to his crib, and if some one or more of the adults in his environment seem to get their way by a constant succession of emotional upsets.

The old point of view as first promulgated by Watson (102), that personality is solely the result of the habits we form, is no longer tenable, inasmuch as we cannot avoid accepting hereditary predispositions toward certain types of reactions as the basis on which habits are formed. However, there is some validity in this viewpoint, inasmuch as habits do make up to a large degree the personality of the individual. If we were to put three individuals with different hereditary predispositions in the same environments, they would react largely in terms of these hereditary predispositions. The same environment, then, would not produce the same type of personality development but might, on the contrary, increase the differences between the three.

Gesell (24) has stated that the differences in personality can be observed almost immediately after birth, and the writer tends to agree with him.

It is possible for the environment to produce abnormalities of behavior no matter how stable the personality of the child at birth. We have had in our nursery group individuals who during the first week in which they attended had as many as thirty-six temper tantrums. Other individuals have never throughout three years of attendance had temper spells violent enough to be called tantrums.

Those who show high visceral instability like the first group may be reconditioned to such an extent that they show few temper spells. On the other hand, those who show no temper spells, if constantly frustrated and overstimulated, may be made to develop them.

The writer has in mind the case of a child who was kept by an institution until it could be adopted by the best type of family because the child was so unusual as to personality and intelligence. When he was eighteen months old, a young couple, who appeared to reach all the standards set by the institution, adopted the boy.

When he left the institution, he had a high degree of emotional stability, was apparently in perfect health, a friendly baby who attracted attention wherever he went because of his unusual charm. After six months had elapsed, the child was returned to the institution as a serious behavior problem. In one of his violent temper spells he had broken several dishes. He had cut his father's head with a metal engine. He was so nervous as to appear pathological.

He had lost weight because he refused most of the foods necessary for normal health and growth at his age. In six months an unusually fine child had been turned into a serious behavior problem.

Interviews with the parents and observations of their treatment of the child offered sufficient explanation of the boy's condition. The father and mother quarreled constantly about methods of dealing with the child. He was alternately spanked and petted. Because of the mother's phobia in regard to germs, the boy had not been allowed to go near anyone except the foster mother and father. If he approached other children on the street, he was screamed at. When he was found petting a dog, he was spanked violently. His foster mother sat with him at the table and scolded him if he did not eat everything on his plate, and the quantity on his plate was sufficient for an adolescent, not a preschool child. Stuffing had resulted in regurgitation, and this in turn had conditioned the child against many foods. When, on one occasion, he had refused to drink milk because it was slightly sour, his nose had been held and the milk poured down until he choked. His foster mother because of her phobia in regard to illness waked him up at night to see if he was resting quietly. When reproved by her husband for this practice, she had violent temper spells.

It is hardly necessary to explain further the conditions which had produced a severe behavior problem in what once had been an unusually attractive and well-balanced infant. A year in the institution was necessary before the boy was in condition to be adopted again, though traces of the treatment which he had received still remained and will probably remain throughout life.

This is an unusually serious case but similar, though less severe, instances may be multiplied indefinitely.

The researches of Mead and Bateson (2) give an excellent picture of changes in personality brought about by the treatment which the children receive before the age of six. Researches indicate that what has been interpreted as a characteristic of the Balinese as a race is largely the result of environmental conditions.

The Balinese have a number of habit patterns suggestive of the behavior of dementia praecox patients. When the houseman has broken a dish or some valuable art object, instead of covering up the accident with excuses or becoming angry and fearful, he falls asleep. Reference to the same accident at a later date also produces sleep or a trance. The Balinese is calm and undisturbed. When he has to wait for a potential customer or to carry on any type of business, his behavior again approaches the abnormal. A short wait produces no results, but after a long one he appears to go off into some dream of his own while, at the same time, he picks his hands and shows other motor behavior characteristic of dementia praecox cases.

This whole picture Mead and Bateson interpret in the light of the way in which the Balinese are treated as young children. When a baby reaches for something, his mother is apt to wait until his hand has almost reached the desired object then grab it away. The object is held in front of him again, and again as he approaches success the object is pulled out of his reach. The play may be varied by throwing the object to the father, who holds it out to the child and as he approaches throws it to his mother. This goes on until the child breaks down. The parents appear to enjoy the emotional upsets they have caused.

Inheritance from the Near Ancestry

Just as Maier* and others have demonstrated that continual thwarting of rats and sheep produces nervous breakdown, thwarting children may react in the same way. However, the Balinese are brought up in a relatively stable environment except for the above-described treatment by their parents, so a true breakdown does not develop. Their life during infancy, however, is disagreeable and full of thwartings which make them early learn to escape from it. In later life they meet anything which may or does produce disagreeable consequences with an escape that is either sleep or withdrawal into daydreams. No recent study has shown so clearly as this one the effect of the early treatment of the infant on his later mental health. Such study as the author has been able to make of the development of behavior problems indicates clearly that, except for certain minor maladjustments, most of the behavior problems of adolescence and of early childhood are the result of experiences up to and including the age of six. Tendencies to worries, fears, sullenness, and even shut-in personality and other serious variations from normal behavior seem clearly to be traceable to treatment received during the first six years. Often such asocial tendencies may be traced to treatment received during the first year.

* For a full description of this work see N. R. F. Maier, "Studies of Abnormal Behavior in the Rat. I. The Neurotic Pattern and an Analysis of the Situation Which Produces It," Harper & Brothers, New York, 1939; N. R. F. Maier, and N. M. Glaser, "Studies of Abnormal Behavior in the Rat. II. A Comparison of Some Convulsion-producing Situations," *Comparative Psychology Monographs*, Vol. 16, No. 1, 1940; N. R. F. Maier, N. M. Glaser, and J. B. Klee, "Studies of Abnormal Behavior in the Rat. III. The Development of Behavior Fixations through Frustration," *Journal of Experimental Psychology*, pp. 521–546, Vol. 26, 1940; see also the work of F. Humphrey and F. Marcuse, "New Methods of Obtaining Neurotic Behavior in Rats," *American Journal of Psychology*, pp. 616–619, Vol. 52, 1939.

Contrariness, tendencies to temper tantrums, to feelings of inferiority, to lack of initiative and independence, as well as desirable character traits, appear to have as their basis the influences by which children have been surrounded during the period from infancy to school age.

To summarize, personality is the result of environment reacting upon hereditary predispositions. Both play their part, though if it were necessary to give weight to environment as against heredity in the development of personality, the preponderance of evidence indicates that environment plays a somewhat larger part.

Apparently in all the four fields which we have examined —physical make-up, mental level, special abilities and disabilities, and personality—hereditary predispositions and environmental conditions each play a part. Environment seems to be most effective in changing health conditions and personality make-up, and least effective in changing mental level and such physical conditions as eye and hair color, the shape of the head, and so on. Since the effect of environment appears to depend in part on hereditary predispositions, these should be determined as far as possible and taken into account where a knowledge of them would appear to be useful. Since the environment has already played an enormous part in the life of the three-year-old, or even of the two-year-old, as many facts about his previous history as can be obtained should be on record to be used by those who have his training in charge. These records will serve to explain much of children's behavior that might otherwise be inexplicable. Such records will also give facts which may be of great assistance in eliminating bad habits or attitudes. Knowledge of present health conditions and previous health record, mental level insofar

as this can be determined, special abilities and disabilities insofar as these may be measured, family history, and previous environment—all these things are necessary if children's behavior is to be interpreted and guided.

Bibliography

1. ANDERSON, JOHN E.: "The Prediction of Terminal Intelligence from Infant and Pre-school Tests," in "Intelligence: Its Nature and Nurture, Thirty-ninth Yearbook of the National Society for the Study of Education," Part I, Chap. XIII, pp. 385–401, Public School Publishing Company, Bloomington, Ill., 1940.
2. BATESON, GREGORY, and MARGARET MEAD: "Balinese Character," New York Academy of Sciences, New York, 1942.
3. BAYLEY, N., and H. E. JONES: "Environmental Correlates of Mental and Motor Development: a Cumulative Study from Infancy to Six Years," *Child Development*, **8**, 329–341, 1937.
4. BLACKER, C. P.: "Chances of Morbid Inheritance," H. K. Lewis, London, William Wood & Company, Baltimore, 1934.
5. BLATZ, W. E.: "Collected Studies on the Dionne Quintuplets," University of Toronto Press, Toronto, 1937.
6. BLATZ, W. E.: "The Five Sisters," William Morrow and Company, Inc., New York, 1938.
7. BOOK, W. F.: "The Intelligence of Highschool Seniors," Chap. X, The Macmillan Company, New York, 1932.
8. BRADLEY, I. A.: "Manic-depressive Psychosis in Identical Twins," *American Journal of Psychiatry*, **9**, 1061–1064, 1930.
9. BRIDGES, J. W., and L. E. COLER: "The Relation of Intelligence to Social Status," *Psychological Reviews*, **24**: 1–31, 1917.
10. BURKS, B. S.: "On the Relative Contributions of Nature and Nurture to Average Group Differences in Intelligence," *Proceedings of the National Academy of Science*, **24**, 276–282, 1938.
11. CARTER, H. D.: "Identical Twins Reared Together," *Journal of Heredity*, **23**, 53–66, 1932.
12. CARTER, H. D.: "Ten Years of Research on Twins: Contributions to the Nature-nurture Problem," in "Intelligence: Its Nature and Nurture, Thirty-ninth Yearbook of the National Society for the Study of Education," Chap. VIII, pp. 235–255, Public School Publishing Company, Bloomington, Ill., 1940.

13. Cockayne, E. A.: "Inherited Abnormalities of the Skin and Its Appendages." Humphrey Milford, John Johnson at the Oxford University Press, London, 1933.

14. Conklin, E. G.: "Heredity and Environment in the Development of Men," 6th ed., Princeton University Press, Princeton, N. J., 1929.

15. "Cyclopedia of Medicine," section on Pregnancy, F. A. Davis Company, Philadelphia, 1939.

16. Demerec, M.: "What Is a Gene?" *Journal of Heredity*, **24**, 369–378, 1933.

17. Diehl, K., and O. von Verschuer: "Erbuntersuchungen an tuberkulosen Zwillingen," *Beiträge zur Klinik der Tuberkulose*, **75**, 206–215, 1930.

18. Dunn, L. C.: "Heredity and Variation," University Society, Inc., New York, 1934.

19. Eaton, O. N.: "A Summary of Lethal Characters in Animals and Man," *Journal of Heredity*, **28**: 320–326, 1937.

20. Freeman, F. N.: "Heredity and Environment in the Light of the Study of Twins," *Scientific Monthly*, **44**: 13–19, 1937.

21. Freeman, F. N., K. J. Holzinger, and B. C. Mitchell: "The Influence of Environment on the Intelligence, School Achievement and Conduct of Foster Children," in "Twenty-seventh Yearbook of the National Society for the Study of Education," Part I, pp. 103–217, Public School Publishing Company, Bloomington, Ill., 1928.

22. Galton, Francis: "Inquiries into the Human Faculty and Its Development," Everyman's Library, 1883; E. P. Dutton & Company, Inc., New York, 1919.

23. Gesell, Arnold: "Infancy and Human Growth," The Macmillan Company, New York, 1928.

24. Gesell, Arnold, and L. B. Ames: "Early Evidences of Individuality in the Human Infant," *Scientific Monthly*, **44**: 217–225, 1937.

25. Goldschmidt, R. B.: "Theory of the Gene," *Scientific Monthly*, **46**: 268–273, March, 1938.

26. Goodenough, Florence L.: "New Evidence on Environmental Influence on Intelligence," in "Intelligence: Its Nature and Nurture, Thirty-ninth Yearbook of the National Society for the Study of Education," Part I, Chap. XI, pp. 307–365, Public School Publishing Company, Bloomington, Ill., 1940.

27. Gun, W. Y. J.: "Hemophilia in the Royal Caste," *Eugenics Review*, January, 1938.

28. Hartmann, H., and F. Stumpf: "Psychosen bei eineiigen Zwillingen," *Zeitschrift für die gesamte Neurologie und Psychiatrie*, **123**: 251–298, 1929–1930.

29. Hilgard, J. R.: "The Effect of Early and Delayed Practice on Memory and Motor Performances Studied by the Method of Co-twin Control," *Genetic Psychology Monographs*, **14**: 493–567, 1933.

30. Hogben, L.: "Nature and Nurture," W. W. Norton & Company, Inc., New York, 1933.

31. Hogben, L.: "Genetic Principles in Medicine and Social Sciences," Alfred A. Knopf, New York, 1931; Williams & Norgate, Ltd., London, 1931.

32. Honzik, M. F.: "Age Changes in the Relationship between Certain Environmental Variables and Children's Intelligence," in "Intelligence: Its Nature and Nurture, Thirty-ninth Yearbook of the National Society for the Study of Education," Part II, Chap. XI, pp. 185–205, Public School Publishing Company, Bloomington, Ill., 1940.

33. Jenkins, R. L.: "Dissimilar Identical Twins: Results of Brain Injury at Birth," *American Journal of Orthopsychiatry*, **5**: 39–42, 1935.

34. Jennings, H. S.: "The Biological Basis of Human Nature," W. W. Norton & Company, Inc., New York, 1930.

35. Jennings, H. S.: "Genetics," W. W. Norton & Company, Inc., New York, 1935.

36. Jones, Harold E.: "Twins," *California Monthly*, **24**: 24–25, 1930.

37. Koch, cited by Carter in "Ten Years of Research on Twins: Contributions to the Nature-nurture Problem," in "Thirty-ninth Yearbook of the National Society for the Study of Education," Chap. VIII, p. 239, Public School Publishing Company, Bloomington, Ill., 1940.

38. Komai, T., and G. Fukuoko: "A Set of Dichorionic Identical Triplets," *Journal of Heredity*, **22**: 233–243, 1931.

39. Lange, J.: "Leistungen der Zwillingspathologie für die Psychiatrie," *Allgemeine Zeitschrift für Psychiatrie*, **90**: 122–142, 1929: *Wiener klinische Wochenschrift*, **42**: 1213–1217, 1247–1250, 1929.

40. Leahy, A. M.: "Nature-nurture and Intelligence," *Genetic Psychology Monographs*, **17**: 235–308, 1935.

41. Leahy, A. M.: "A Study of Adopted Children as a Method of Investigating Nature-nurture," *Journal of the American Statistical Association*, **30**: 281–287, 1935.

42. LEAHY, A. M.: "A Study of Certain Selective Factors Influencing Prediction of the Mental Status of Adopted Children," *Pedagogical Seminary and Journal of Genetic Psychology*, **41**: 294–329, 1932.

43. LEREBOULLET, P.: "Les jumeaux: leur physiologie; leur pathologie; l'identité de jumeaux univitellins (Disease Similarities in Identical Twins)," *Nourrisson*, **23**: 277–296, 1935.

44. LEWIS, A.: "A Case of Apparent Dissimilarity of Monozygotic Twins," *Annals of Eugenics*, **7**: 58–64, 1936.

45. LEY, J., and G. W. TORDEUR: "Alexie et agraphie d'évolution chez des jumeaux monozygotiques," *Journal belge neurologie et psychiâtre*, **36**: 203–222, 1936.

46. LOEVINGER, JANE: "Intelligence as Related to Socio-economic Factors," in "Intelligence: Its Nature and Nurture, Thirty-ninth Yearbook of the National Society for the Study of Education," Part I, Chap. V, pp. 159–210, Public School Publishing Company, Bloomington, Ill., 1940.

47. MCNEMAR, QUINN: "A Critical Examination of the University of Iowa Studies of Environmental Influences upon the IQ," *Psychological Bulletin*, **37**: (2): 63–92, February, 1940.

48. MEAD, MARGARET: "Coming of Age in Samoa," William Morrow and Company, Inc., New York, 1928.

49. MEAD, MARGARET: "Growing Up in New Guinea," William Morrow and Company, Inc., New York, 1930.

50. MITCHELL, GRAEME, W. B. UPHAM, and E. WALLINGER: "Pediatrics and Pediatric Nursing," The Macmillan Company, New York, 1939.

51. MOHR, O. L.: "Heredity and Disease," W. W. Norton & Company, Inc., New York, 1934.

52. MORGAN, T. H.: "Scientific Basis of Evolution," W. W. Norton & Company, Inc., New York, 1932.

53. MORGAN, T. H.: "The Theory of the Gene," Yale University Press, New Haven, 1926.

54. NEFF, W. S.: "Socio-economic Status and Intelligence: A Critical Survey," *Psychological Bulletin*, **35**: 727–757, 1938.

55. NEWMAN, H. H.: "Evolution, Genetics and Eugenics," 3d ed., University of Chicago Press, Chicago, 1932.

56. NEWMAN, H. H.: "Identical Twins," *Scientific Monthly*, **34**: 169–171, 1932.

57. NEWMAN, H. H.: "Identical Twins: The Difference between Those Reared Apart," *Eugenics Review*, **22**: 29–34, 1930–1931.

58. Newman, H. H.: "Mental and Physical Traits of Identical Twins Reared Apart: Case IV. Twins Mary and Mabel, and Review of the First Four Cases Studied," *Journal of Heredity*, **23**: 3–18, 1932.

59. Newman, H. H.: "The Palmer Dermatoglyphics of Twins," *American Journal of Physical Anthropology*, **14**: 331–378, 1930.

60. Newman, H. H.: "Palm-print Patterns in Twins; on the Use of Dermatoglyphics as an Aid in the Diagnosis of Monozygotic and Dizygotic Twins," *Journal of Heredity*, **22**: 41–49, 1931.

61. Newman, H. H., F. N. Freeman, and K. J. Holzinger: "Twins: A Study of Heredity and Environment," University of Chicago Press, Chicago, 1937.

62. Orel, H.: "Langen-und Massenwachstum von Zwillingen. Kleine Beiträge zur Verebungswissenschaft. (Growth in Length and Weight in Twins VII. The Knowledge of Heredity)," *Zeitschrift für Kinderheilen*, **48**: 1–14, 1929.

63. Parshley, H. M.: "Science of Human Reproduction," W. W. Norton & Company, Inc., New York, 1933.

64. Pearl, R. J., and R. de W. Pearl: "Ancestry of the Long-lived," The Johns Hopkins Press, Baltimore, 1934.

65. Philiptschenko, J.: "Studies of Inheritance of Musical Talent," *Bulletin of the Bureau of Genetics and Plant Breeding*, Vol. V, Leningrad, 1927.

66. Pincherle, B.: "Diverso comportamento di due gemelli monocorii di fronte alla silfilide materna (Opposite Behavior of Monochorionic Twins with Reference to Maternal Syphilis)," *Pediatria*, **42**: 1207–1220, 1943.

67. Popenoe, Paul: "The Child's Heredity,' The Williams & Wilkins Company, Baltimore, 1929.

68. Popenoe, Paul, and R. S. Johnson: "Applied Eugenics," 2d ed., The Macmillan Company, New York, 1933.

69. Pressey, S. L., and R. Ralston: "The Relation of the General Intelligence of School Children to the Occupation of Their Fathers," *Journal of Applied Psychology*, **3**: 366–373, 1919.

70. Rasmussen, Vilhelm: "Child Psychology," p. 26, Alfred A. Knopf, New York, 1923.

71. Reed, G. E.: "Uniovular Twins: Schizophrenia and Tuberculosis," *Canadian Medical Association Journal*, **32**: 180–182, 1935.

72. Reed, Homer B.: "The Influence of Training on Changes in Variability in Achievement," Psychological Review Company, Princeton, N. J., and Albany, N. Y., 1931.

73. Richardson, S. K.: "The Correlation of Intelligence Quotients of Siblings at the Same Chronological Age Levels," *Journal of Juvenile Research*, **20**: 186–198, 1936.

74. Rosanoff, A. J., L. M. Hundy, and I. R. Plesset: "The Etiology of Mental Deficiency with Special Reference to Its Occurrence in Twins: A Chapter in the Genetic History of Human Intelligence," *Psychological Monographs*, **48**: 1–37, 1937.

75. Rosanoff, I. A., and A. J. Rosanoff: "A Study of Mental Disorders in Twins," *Journal of Juvenile Research*, **15**: 268–270, 1931.

76. Rose, Mary Schwartz: "Feeding the Family," Chap. IV, "Foundations of Nutrition," pp. 445–450, The Macmillan Company, New York, 1940.

77. Scheinfeld, Amram, and Morton D. Schweitzer: "You and Heredity," Frederick A. Stokes Company, Inc., New York, 1939.

78. Schott, E. L.: "IQ Changes in Foster Home Children," *Journal of Applied Psychology*, **21**: 107–112, 1937.

79. Seashore, Carl E.: "Studies in the Psychology of Music"; Vol. II, by Hazel M. Stanton, "Measurement of Musical Talent" (with chapter on Inheritance); Vol. IV, "Objective Analysis of Musical Performance," University of Iowa, Iowa City, 1937.

80. Skeels, H. M.: "Mental Development of Children in Foster Homes," *Pedagogical Seminary and Journal of Genetic Psychology*, **49**: 91–106, 1936.

81. Skeels, H. M.: "Mental Development of Children in Foster Homes," *Journal of Consulting Psychology*, **2**: 33–43, 1938.

82. Skeels, H. M.: Some Iowa Studies of the Mental Growth of Children in Relation to Differentials of Environment, in "Intelligence: Its Nature and Nurture, Thirty-ninth Yearbook of the National Society for the Study of Education," Part II, Chap. II, pp. 281–305, Public School Publishing Company, Bloomington, Ill., 1940.

83. Skeels, H. M., and E. A. Fillmore: "Mental Development of Children from Under-privileged Homes," *Pedagogical Seminary and Journal of Genetic Psychology*, **50**: 427–439, 1937.

84. Skeels, H. M., R. Updegraff, B. L. Wellman, and H. M. Williams: "A Study of Environmental Stimulation: An Orphanage Project," *University of Iowa Studies in Child Welfare*, **15**: 5–191, 1938.

85. Skodak, M.: "The Mental Development of Adopted Children Whose True Mothers are Feeble-minded," *Child Development*, **9**: 303–308, 1938.

Chapter - - - - - - - - - - - - - - Three

INNATE EQUIPMENT COMMON TO ALL HUMAN INFANTS

THE DEGREE TO WHICH BEHAVIOR AND GENERAL AND specific capacities can be predicted on the basis of the known ancestry has been discussed from the standpoint of the general consensus of opinion and experimental results. Obviously the near ancestry of the individual determines to some extent both his general and special capacities and his behavior. A certain part of the equipment of each individual consists of elements which are determined by the fact that he is human. That is to say, there is certain equipment common to all the human species. The physical equipment which comes under this heading we shall discuss in connection with the "reaction hypothesis,"* *viz.*, that all behavior, whether it be thinking, reasoning, imagining, or actual muscular reaction, is in response to some stimulus. Such an hypothesis involves (*a*) organs for the

* According to this hypothesis, as formulated by Woodworth (32) and later used by Gates, the cortex itself constitutes a responding organ, and thinking, perceiving, imagining, remembering, and the like occur in response to stimuli just as do reactions in terms of muscular and glandular activities. Since the writer takes the same position as does Gates, cortical reactions will be treated as forms of behavior in response to definite stimulations, just as the bodily changes which occur in anger and fear states will be treated as forms of response to the stimuli which produced them.

reception of stimuli; (*b*) organs of response; (*c*) a connecting and coordinating mechanism.

Equipment which comes under each of these headings is common to all human young and is present and, for the most part, functioning at birth. The operation of the organs for the reception of stimuli and their interrelations must be known, in part, at least, if the behavior of the organism is to be predicted and controlled, or even if such behavior is to be observed intelligently.

The path of a stimulus which produced any type of behavior would be from the organs for the reception of stimuli through the connecting and controlling mechanism to the organs of response. We shall discuss these mechanisms in this order.

ORGANS FOR THE RECEPTION OF STIMULI AND RESPONSE TO STIMULI

The General Cutaneous Sensations. Probably the first sensations of which the child becomes vaguely aware are those which have to do with touch, temperature, and pain. During the birth process the child receives a constant train of sensations from the organs of pressure and pain. Immediately after birth he experiences a change of temperature. The organs for cutaneous sensations, *i.e.*, heat, cold, pressure, and pain, are scattered all over the surface of the body. If one marks off an area an inch square on the back of the hand, and passes over this area a pointed instrument which has been heated, certain spots will yield a sensation of warmth; others, mainly in the regions of the hair follicles, will give sensations of touch. A cold instrument passed over the same area will produce sensations of cold at spots differing from those at which warmth and touch were experienced. Pain is mediated by yet other

end organs. Pressure is felt when an instrument is placed against the skin with some force; touch when the surface of the skin is touched lightly. The whole surface of the skin contains these end organs for mediating the cutaneous sensations. Gates* gives the following approximations as to the number and distribution of such end organs. There are 3 to 6 million of such receptors. About 2 to 4 million mediate pain, about 500,000 mediate touch and pressure sensations, and about 500,000 mediate cold. There are approximately 30,000 "warm spots."

It is probable that the embryo during the later periods of intrauterine development is sensitive to changes in temperature. There appears to be little question that sensitivity to light touch and to pressure are present for some months before birth.

Carmichael (5, 6, 7), in his work on embryonic guinea pigs, demonstrated clearly their response to tactile stimulation. Coghill (10) shows the same responses in amblystoma. Sontag (27) has recently shown responses to other sensory stimulation in intrauterine development.

Children are probably more sensitive to heat, cold, pressure, and pain than are adults, inasmuch as such evidence as we have points to the fact that there are the same number of organs for the reception of the general cutaneous sensations in the child as there are in the adult. There are, therefore, more of such organs to each area in the infant than in the individual of larger size.

Analysis of the apparatus of the nursery school and kindergarten will show a wide range of material calculated to yield sensory impressions. The use of the hot and cold

* Gates, *op. cit.*

water in bathroom procedures and play with cold and warm objects out of doors are only two examples of the use of hot and cold stimuli. Tactile stimuli are presented by the cloths of different materials with which the children play, sand, and the textures of the blocks, books and furniture, other children's clothing, cloth and wool animals, and so on, through an infinite variety of diversified materials.

Gustatory Sensations. The organs of taste are scattered over the upper surface of the tongue and, in the young child, over the inside of the cheek area as well. It is known that much of the child's early development depends upon his taste sensations, *i.e.*, the sensations of sweet, salt, sour, and bitter. The infant appears to react to these sensations in the same way as does the adult, although it is doubtful whether he distinguishes the different qualities as clearly. From the time when the child can put objects into his mouth, he tastes anything which can be brought in contact with the tongue. The tendency to experiment with objects with the lips and tongue appears to be particularly prominent about the time the child is six months old. The sense of taste seldom acts alone; it is most frequently associated with the sense of smell and with touch and temperature.

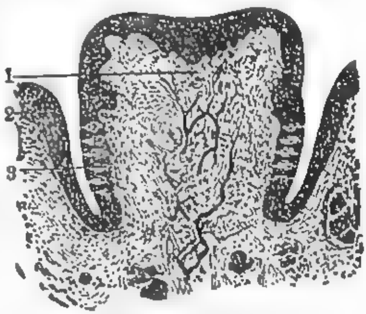


FIG. 1.—Cross section of surface of tongue showing location of the taste buds. Taste buds are shown as 3. (*From H. A. Carr, "Psychology," Longmans, Green and Company, New York.*)

Olfactory Sensations. The organs for the reception of smell are nerve fibers, the cell bodies of which lie in the olfactory bulbs. These fibers lie in the mucous membrane

of the nose. The stimuli which cause the sensation of smell are mainly particles of a gaseous nature.* When substances are put into the mouth, these gaseous particles act in connection with the actual gustatory sensations, sweet, salt, sour, and bitter, to produce what we commonly call the sense of taste. If the passages of the nose were closed, it would often be difficult to determine what an object was by the sense of taste alone.

Reactions to taste are conditioned with relative simplicity. In spite of the fact that negative reactions to sour are a part of the Kuhlman Intelligence Test at age two, children can be conditioned to enjoy sour as represented in pickles and other objects arousing taste sensations. Strong tastes of salt arouse negative reactions in early childhood, but adults react positively to objects containing strong salt solution, such as anchovy, caviar, and olives. Strong tastes, *i.e.*, objects which have a strong odor, will by reacted to positively or negatively by the child in terms of the general attitude of the adult, not in terms of the strength of the sensation itself.

Such substances as cod-liver oil are now reacted to positively by children in nursery school, whereas it used to be the custom to cover up the taste of the cod-liver oil by putting it in orange or tomato juice. One even sometimes finds that children have been positively conditioned to cod-liver oil while no attempt has been made to make them like tomato juice. The latter is refused and the cod-liver oil is taken plain with much pleasure.

Whereas cases were rare in which cod-liver oil was even tolerated ten years ago, we have on record a number of

* There is some indication that metallic particles also give olfactory sensations.

children who receive additional cod-liver oil as a reward for good behavior. For example, two children, twins, had as their reward for being good during the day one spoonful of cod-liver oil. When they were particularly good, the reward consisted of a second spoonful of cod-liver oil.

On the other hand, children have been conditioned against foods by negative attitudes on the part of the individuals who presented them though the reaction is originally positive. Odor, taste, and cutaneous sensations are so closely bound up in most so-called "tastes" and "flavors" that when one is conditioning for taste, one is also conditioning for the others. In sense qualities, cod-liver oil has little actual taste, but its odor and its oily consistency may be reacted to negatively unless children have been conditioned to react positively by some such methods as were used with the children in the illustration cited above. The ease with which reactions may be conditioned in this field should be kept in mind, inasmuch as it is possible to condition to positive reaction toward wholesome foods and to negative reactions toward unwholesome ones.

On the whole, the best educational procedure is to condition toward a high degree of positive reaction toward wholesome foods rather than to initiate even in early childhood negative reactions which may at a later date have to be reconditioned.

The school lunch for kindergarten children and the lunch hour in nursery schools are usually employed for this reconditioning in children beyond infancy.

Visual Sensations. The organs for the reception of visual sensations are the rods and cones distributed in the retina

of the eye. These organs mediate primarily sensations of color and brightness, but, from the time when the child is

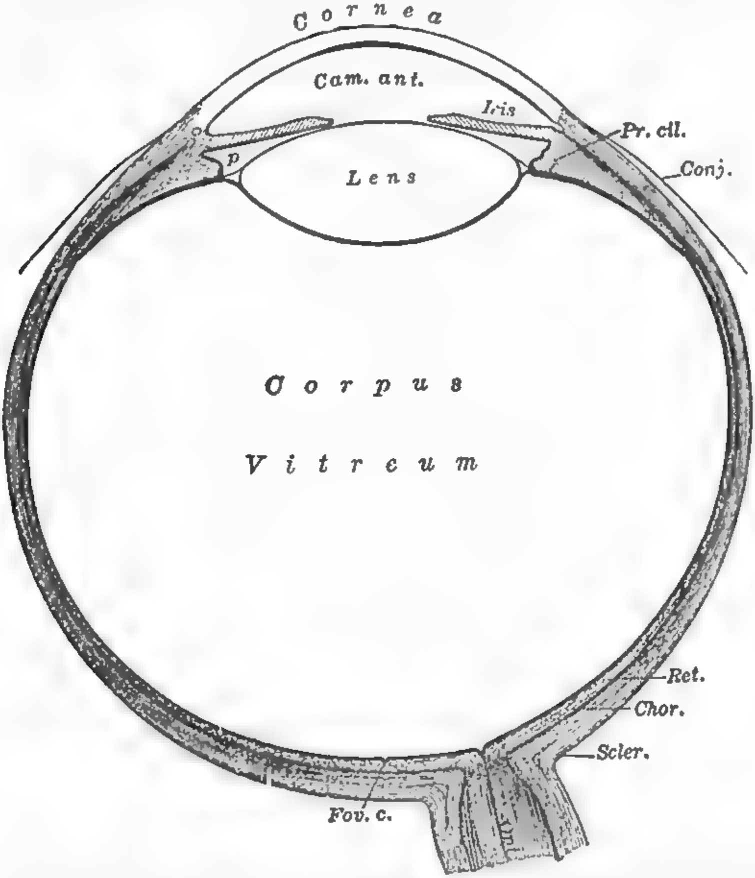


FIG. 2.—Cross section of the human eye. *Scler.*, sclerotic coat; *Chor.*, choroid; *Ret.*, retina; *Opt.*, optic nerve; *Fov. c.*, fovea; *Pr. cil.*, the ciliary muscle or ciliary process; *Conj.*, conjunctiva; *Cam. ant.*, the anterior chamber; *Corpus vitreum*, the vitreous humor that fills the posterior chamber. (*From H. A. Carr, "Psychology," Longmans, Green and Company, New York.*)

able to focus his eyes upon an object, the end organs for vision begin to interpret objects in terms of sensations received previously from other end organs, *e.g.*, sensations

of softness, hardness, smoothness, roughness, shape, size, and distance all of which have been developed by a process of association between certain types of visual stimuli and the cutaneous and kinesthetic sensations. The child touches a rough object and at the same time sees the lights and shadows produced by the peculiarities of its surface. This process is repeated again and again, until the mere sight of a surface giving these visual sensations is sufficient to make the child react to the surface as "rough," without the necessity of feeling it and thereby arousing the cutaneous sensations which such a rough surface would produce.

In the young child, clear vision is extremely difficult, inasmuch as, in order to see an object clearly, he must be able to focus the eyes so that he obtains adequate binocular vision. The six eye muscles attached to the sclerotic coat of each eye do not work together in a coordinated way in the young child; his visual sensations must, therefore, be somewhat blurred, except where they are received by each eye working individually. It is not until the child reaches the age of six months, or thereabouts, that the functions of convergence and accommodation are developed to such an extent that he is able to make use of anything like the binocular vision of the adult.

It is highly probable that the muscles of the eye show the same lack of perfect coordination for the first six years of life that is found in the other muscles of the infant and young child. A high degree of incoordination is also present in the large muscles. Skipping with two feet is relatively impossible before kindergarten age. Since this appears to be the case, any work which requires close accommodation would place an undue strain on the eye muscles. Sewing, fine weaving, and reading are among the

activities which appear to place strain to such a degree that the eyes may be permanently damaged. If there is no other reason for deferring the teaching of reading and Terman and his associates (29) appear to have found an even better one in lack of sufficient mental maturity until the age of six, the strain which the adjustments involved in reading place on the muscles of the child, all the way from those involved in sitting still to the eye muscles themselves, is too severe. The increase in eye defects requiring glasses as children progress through the grades should be adequate indication that too much strain is being placed on this organ.

As will be pointed out in later chapters on learning, the eye is the organ which becomes the interpreter of sensations from the other organs of reception. When one says that the object is smooth when it has been seen and not touched, one is using the eye to carry sensations previously received from the organs mediating cutaneous sensations. When one says the object is pointed, again the visual sensations are being used to carry sensations previously received from other sense organs, in this case the kinesthetic and cutaneous organs of reception.

The eye is such a complicated mechanism that it is easy to disturb the extent to which it mediates stimuli. There may be defects in the way in which the lens flattens for distant vision, or assumes a spherical shape for objects close at hand. There may be difficulties in the adjustments of the six muscles which control the movements of the eye. Stimuli cannot be mediated normally unless the accessory apparatus is functioning correctly, even though the rods and cones receive and transmit stimuli.

Auditory Sensations. The end organs of hearing are to be found in the cochlea of the ear. The stimuli to hearing

are vibrations of air; the sensations mediated are noises and tones. Sontag (28) has pointed out that there appear to be some responses to auditory stimuli during the late intra-uterine period. Since it is difficult to determine whether these are vibratory in nature and therefore mediated by kinesthetic and cutaneous end organs or whether they are truly auditory in nature, it is necessary to postpone our discussion of this point.

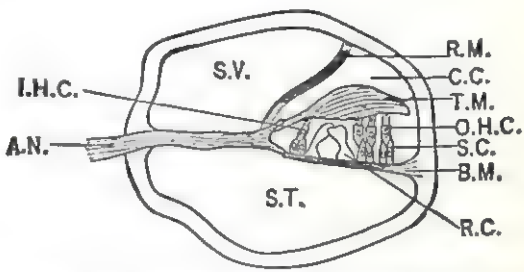


FIG. 3.—Diagram of the cochlea seen in transverse section. *S.T.*, the scala tympani; *S.V.*, the scala vestibuli; *C.C.*, the canal of the cochlea; *B.M.*, the basilar membrane; *R. M.*, Reisner's membrane; *T.M.*, tectorial membrane; *I.H.C.*, inner row of hair cells; *O.H.C.*, outer row of hair cells; *S.C.*, supporting cells; *R.C.*, rods of Corti. (*From Angell, "Psychology," Henry Holt and Company, Inc.*)

The baby cannot hear clearly during the first forty-eight hours of his life because of the mucus in the inner ear; after that time he appears to be able to react to sensations of sound. The average parent is unaware that the child begins to hear almost immediately after birth and that he reacts to differences in tone not long after this time. Loud shouts as well as loud noises of any kind, as we shall see in the discussion of fear states, produce fears within a few days after birth.

We have already noted the response of embryonic animals and of humans to tactile sensations.

Loud noises, long continued, would appear to increase the general tension under which the young child lives. This does not mean that children should be protected from sounds of all sorts, but only that they should not be sub-

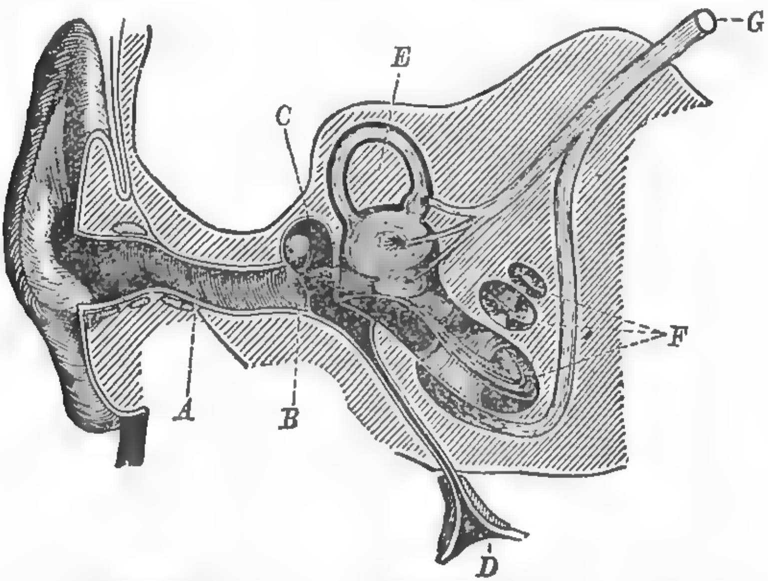


Fig. 4.—Diagram of the ear. *A*, auditory canal of the external ear; *B*, tympanic membrane separating the external from the middle ear, *C*; *D*, Eustachian tube leading from the middle ear to the throat; *E*, one of the semicircular canals of the internal ear, arising out of the utricle upon which, as upon the adjacent saccule, fibers from the vestibular branch of the eighth nerve are shown terminating; *F*, the spiral of the cochlea, through the central pillar of which the auditory nerve is shown entering to spread out toward the hair cells of the cochlea canal, as indicated in Fig. 4; *G*, the main trunk of the eighth nerve. (*After Hough and Sedgwick.*) (*From Angell, "Psychology," Henry Holt and Company, Inc.*)

jected to the strain of sounds of greater intensity than those produced in the ordinary course of living. Slamming doors, shouting, dropping or throwing about metal objects, and the like constitute sounds to be avoided.

Talking to the child assists him in the discrimination of word sounds. He appears to have interest in the sounds that come from a rattle, from kicking the sides of his crib, and from throwing objects on the floor when this coordination has been acquired, and from other stimulations of this sense organ provided these are of low intensity. He discriminates fairly early between the tone of voice of individuals known and unknown and between the types of sounds produced by different objects. Among his first words will be found some which name the object by the sound it makes, as, for example, calling the dog "Wow Wow," the train "Chu Chu." As children mature, there is an increasing tendency to react in terms of the distance receptors mediating sensations of sight and hearing.

The eye and the ear as distance receptors will, after the first five years of life, serve as the chief receiving organs. A large part of the learning which goes on during the preschool period is in the field of transmuting sensations received from all the organs of reception into visual and auditory terms.

One has only to observe the behavior of infants at home and children in the nursery school and kindergarten to realize how far this preschool period is one of storing up sensory experience of every kind. The child must not only look at, but touch, throw, taste, and smell all movable objects. The resulting sensations are probably used throughout life in interpretation of new experience, largely visual experience.

Postural or Equilibratory Sensations.* In approximately the same area as the cochlea and attached to a portion of that

* For this terminology, I am indebted to Dr. C. J. Herrick.

organ, although apparently not functioning with it, there are three canals lying in three planes at right angles to each other. Within the canals is a fluid which seems to react on the hair cells distributed in the ends of the canals. This end organ appears to give a sense of position, the so-called "static" sense. Its chief function appears to be the maintenance of bodily equilibrium.

Among authors there appears to be a difference of opinion as to whether dizziness is mediated by this organ. The interest of the young child in sensory qualities of all sorts can be seen in his enjoyment of this sensation of dizziness. One has only to watch the play of very young children who have learned locomotion in order to see numerous instances of whirling round and round until the child becomes too dizzy to stand up. Young babies appear to enjoy being placed in different positions, even having a reversal of position in which the head is downward and the feet upward, provided at the same time they are held sufficiently securely to prevent any sensation of falling. Probably early in life, the sensations from the end organ which mediates postural or equilibratory sensations become too faint to be reacted to clearly. They do, however, form the basis of control of the body in space, to go with the kinesthetic sensations whose function in this field is largely integrated with that of the end organs in the semi-circular canals.

Kinesthetic Sensations. The organs for the reception of kinesthetic sensations lie in the muscles, the tendons, and the joints. The kinesthetic sensations are muscular, articular, and tendinous. From this group is developed our knowledge of shape, size, distance, position of the various parts of the body, control of the large and small muscles—

in a word, our knowledge of everything which is related to movements, with the exception of such movements as occur within the viscera. The sensations from the visceral organs, though probably kinesthetic in character, are usually classified separately under the term of "organic" sensations.

The infant is constantly in motion from the time of birth. A film taken of a baby five hours after birth will show motion in all parts of the external musculature, including the facial muscles. These constant motions send a train of sensations to the cortex on the basis of which the child later is able to select and perform required movements. The adult who undertakes an experiment with himself will realize that it is impossible to perform a motion until he has a clear idea of the sensations involved. Electrical stimulation to the group of muscles which it is the purpose of the experimenter to select will give such sensations and therefore often help in gaining the desired control.

The role of the kinesthetic sensations in controlling responses can hardly be overestimated. In terms of these, the individual reacts to weights which he is about to lift by sending sufficient energy to the muscles which will be used. Anyone who has the experience in a psychological laboratory of picking up a weight which appears to be heavy will realize how much he prepares for such weights in advance. If its actual weight is only a matter of an ounce or two and it gives the visual sensations usually associated with great weight, it is likely to be lifted so far into the air as almost to send the individual over backwards. In terms of these kinesthetic sensations, the child interprets relations to space, height, width, depth, and the like. These control his motions as he goes through a small

aperture, bends to pick up a block from the floor, lifts his kiddy-car, or, in fact, performs any activity which requires control of the skeletal muscles.

Destruction of those centers in the cord which mediate kinesthetic and cutaneous sensations result in an extraordinary loss of control over motion. The gait of individuals with a spinal crush in which tracts transmitting kinesthetic and cutaneous sensations have been destroyed is sufficiently peculiar to be recognizable even by the semitrained observer. Through kinesthetic sensations from the muscles in the larynx and the associated areas, vocalization is controlled. According to Watson, much if not all thought goes on in terms of the movements concerned in vocalization. All authorities agree that a certain amount of thought is carried in terms of such movements or the images therefrom. Watson states that an animal can learn a complicated habit like running the maze on the basis of kinesthetic sensations alone. Many of our habitual reactions are almost wholly controlled through these sensations from muscles, tendons, and joints. Writing on a typewriter by the touch system, walking, and running are only a few of the coordinations performed under the control of kinesthetic sensations. As the sensory endings in the muscles, tendons, and joints are stimulated, these arouse new motor impulses which, in turn, arouse additional kinesthetic sensations, and a series of activities go on in sequence and in integrated form. In such coordinations as those above cited, *e.g.*, typewriting by the touch system, practically the whole functioning of the habit is turned over to the kinesthetic system with a certain amount of control through the cutaneous sensations also aroused. In practically all cases in which the muscles, tendons, and joints are stimulated, there is

also stimulation of the cutaneous end organs. In bending the arm, the skin is stretched at the elbow and pressed together at the inside of the bend. In bending the head, there is tension of the skin on one side of the neck and loosening at the side toward which the head bends, as well as a small amount of pressure on certain areas.

A list of the apparatus necessary to give adequate kinesthetic sensations would cover practically everything used by the infant and by the young child. The use of riding toys, the jungle gym, or toys for sweeping and dusting obviously has as its main purpose the production of kinesthetic sensations which will later function in the control of these activities. Form boards and toys of different shapes, picture puzzles from the simple to the complicated, blocks, boxes, boards, and sawhorses, all involve types of activity-producing kinesthetic sensations.

Since control of movement, like sensory experience, is a function of the preschool period, all types of kinesthetic experience are necessary in a well-rounded education of infants and young children.

Organic Sensations. The great group of organic sensations does not lend itself to close analysis. Under this head would come such sensations of organic pressure as suffocation, and such sensations of muscular contraction as those which make themselves felt during strong emotional states.

In spite of the fact that the organic sensations do not lend themselves too closely to analysis, they are a constant factor in behavior of all types. The individual whose visceral organs are functioning normally and who is receiving a sufficient supply of secretions from the endocrine glands has his entire mood determined by these facts.

The individual who feels depressed is largely reacting to a stream of sensations from the internal organs which indicate that these are functioning at low level or that there is actually some abnormality of function which is showing itself not in any pain which can be localized but in the form of general bodily tone. Any student of modern psychology will realize that in the recall of previous experiences, images of these organic sensations play a large part. He remembers with regret which is in part ideational but also in part visceral. If fear is associated with recall, there will not only be a revival of organic images but there will also be actual organic reverberations. The individual who recalls a fearful experience will find himself undergoing the same observable organic changes which occurred during the actual experience and these may be of almost the same degree of intensity. The child who prepares through the auditory and visual channels lessons in reading may also have aroused at the same time those organic sensations which are associated with anger or fear states, and these may be learned with exactly the same degree of ease, if indeed they are not learned more easily than are the elements which go to make up the reading habit.

In every situation in which the individual functions, organic sensations are a part and the individual is conditioned exactly as much for the revival of organic sensations in terms of images as he is for the revival of auditory, visual, gustatory, and other sensations. The sound of the word "castor oil" arouses organic images as quickly as it arouses visual, verbal, auditory, or any other nonorganic image. The importance of correct conditioning in regard to the organic images aroused in every situation can hardly be overestimated.

THE COORDINATING AND CONTROLLING MECHANISM

Child (9) has pointed out clearly the fact that certain parts of the growing organism have dominance over other parts. There is a relation of dominance and subordination in all growing organisms. This relation is most important in cases of excitation and its transmission.

According to Child, "the point of primary excitation is the region of primary dominance." The region of highest excitation in the human organism is the nervous system and it is also the region of highest transmission. The nervous system in the human therefore stands in the position of dominance with the other structures of the organism in the relation of subordination. It is therefore the coordinating and controlling mechanism.

The nervous system in the human organism consists of two divisions: the central nervous system with its end organs lying outside the cord, and the sympathetic nervous system.

The main structures of the central nervous system proper are the brain and the spinal cord. The spinal cord lies in the spinal column, the brain in the skull case. Proceeding from the top down, the structures are as follows: the cerebral hemispheres; the thalamus; the medulla oblongata, which is an enlarged extension of the spinal cord; and the spinal cord. The cerebral hemispheres consist of two much-convoluted structures which rest upon the thalamus. The hemispheres are separated at the extreme inner portion by a deep fissure running through the median line from the rear into the frontal area. The band of fibers, called the "corpus callosum," at the base of this fissure unites the two hemispheres. Without this connecting band the

stimulus which reached one hemisphere would be confined in its action to that hemisphere alone. Both sides of the brain are involved in most conscious processes.

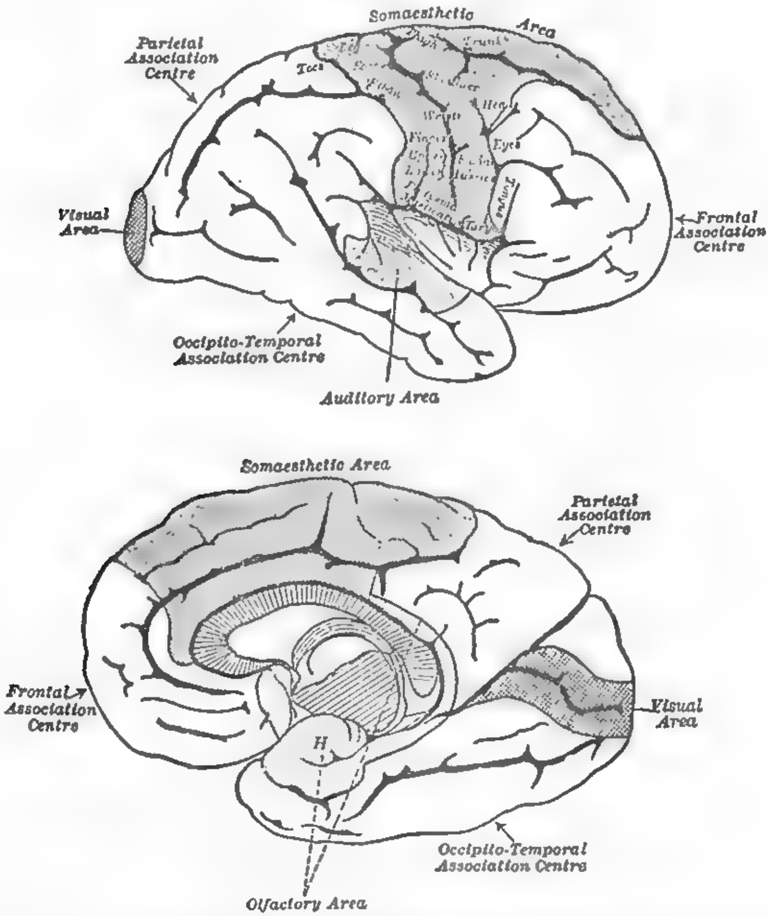


FIG. 5.—Diagrams representing the cortical terminations of the various sensory and motor projection tracts. (*From H. A. Carr, "Psychology," Longmans, Green and Company, New York.*)

On the lateral surface of each hemisphere are two deep fissures called the "fissure of Rolando" and the "fissure

of Sylvius." These can be seen by referring to the diagram above.

In front of the fissure of Rolando lies the major portion of the centers from which proceed impulses to action. Back of this fissure lies the mass of centers to which are transmitted impulses from the organs for the reception of stimuli. There appears to be, to some degree, a definite localization of function. The diagrams on page 84 will show, just posterior to the fissure of Rolando, the sensory area to which are transmitted impulses from the end organs which mediate the general cutaneous sensations. In the temporal area is a center for the reception of stimuli from the ear. The visual area lies at the tip of the occipital lobe. The olfactory area lies infolded under the occipito-temporal area, in the area that corresponds to the olfactory lobes in the lower animals. The motor area lies just in front of the fissure of Rolando. From the end organs to the sensory centers come all the impulses of which we become conscious. From the motor area are sent all the impulses which result in voluntary action. Between these centers lie association areas. The association areas connect the sensory areas with each other and with the motor centers. Destruction of any of the centers has a potent effect upon behavior. A child with the visual center destroyed cannot react to visual stimuli. If there has been destruction of the motor centers, the activity controlled by the center destroyed cannot be controlled voluntarily, though it may still occur if it is also controlled from a lower level. The cortex appears to act as a whole, so that destruction of tissue in any area may affect the performance of a function initiating from another area. The extent and degree to which functions are affected depend upon the location and extent of the tissue destroyed.

Some questions have been raised in connection with localization of function by the recent work of Lashley (19, 20) on the destruction of tissue in relation to behavior. The subjects for this experiment were white rats.

The first experiment in the series, done in 1918 (21) before the publication of the work cited below, was an investigation of the influence of the extent of lesions in the cortex upon the ability of the rat to learn to open a double platform box. The cortical lesions involved from 14 to 50 per cent of the total mass of the cortex with an average area of destruction of 28.4 per cent. The results of this experiment are extraordinary in that animals operated on required 75 per cent as much practice as did normal animals who learned the same principles under the same conditions.

A later study in 1926 (22) indicates that lesions within the area striata did not influence to any significant degree the ability of the animals to master training in brightness discrimination. On the contrary, the animals operated on required only 94 per cent as much practice as did normal animals trained in the same problems under the same conditions. However, animals which had been trained in brightness discrimination lost the habit when the area striata was destroyed after the habit had been acquired. These animals could be retrained in the same habit with approximately the same number of trials that it had taken them to learn it previous to the destruction of the area.

In the series of experiments reported in 1929 (19), the problems involved learning and retention of mazes and learning and retention of brightness discrimination. Areas were removed in all parts of the cerebral cortex. The total extent of the lesions covered every part of the neopallium.

The results for mazes and for learning of brightness discrimination differ. The animals operated on were always somewhat superior in brightness discrimination to the group not operated on. In maze learning, there was a significant difference in favor of the group not operated on. In the cases of all mazes, the removal of parts of the cortex resulted in retardation in learning. The significant fact is not so much the retardation, however, as that the removal of equal amounts of tissue in any cortical area produced an equal amount of retardation. There was also a relationship between the amount of injury and the degree of retention.

These facts, carefully controlled and checked, indicate to Lashley a nonspecificity of cerebral structures for learning. Not only was there no difference quantitatively in the results from lesions in different areas, but there was no qualitative difference in the types of solutions adopted by animals with different types of lesions. There were selective effects upon habits already formed but none on the acquisition of habits.

Such facts as these place us in the position of having to interpret, to some extent at least, our whole idea of definite specificity in cortical areas. If there is in the human brain the same lack of specialization of areas that appears in the much lower form of brain characteristic of the white rat, then it would appear that any portion of the brain might conceivably take over the functions carried by other portions. It must be kept in mind, however, that specialization increases as we go up the biological scale from the amoeboid forms, in which there is no specific organ of any sort, to the human organism, in which specialization seems to have reached its height. It is possible that there

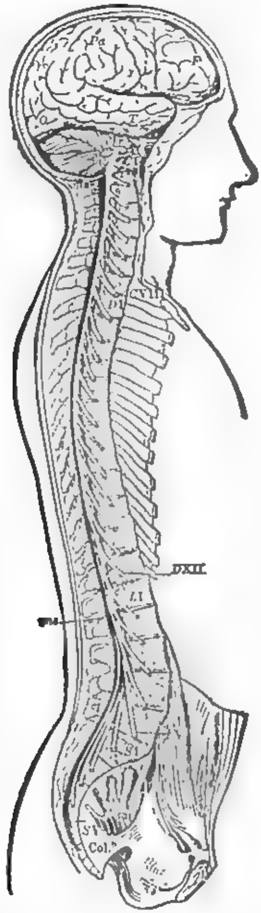


FIG. 6.—Brain, spinal cord, and nerve roots. A longitudinal section through the medial plane of the spinal column and in part of the skull. Lobes of the cerebrum. *Pa*, parietal; *F*, frontal; *O*, occipital; *T*, temporal; *C*, cerebellum; *mo*, medulla oblongata; *CI–CVIII*, cervical nerves; *DI–DXII*, thoracic nerves; *LI–LV*, lumbar nerves; *SI–SV*, sacral nerves; *Col*, coccygeal nerve; *ms*, *ms*, upper and lower extremities of the spinal cord. (*After Bougery.*) (*From H. A. Carr, "Psychology," Longmans, Green and Company, New York.*)

is a high degree of nonspecificity in the rat brain which is not equaled in the human. Further research will be necessary in order to determine the bearing on human behavior of these data on the behavior of rats. Lashley's results might well leave us in the position which he himself takes—that there are no identical elements in terms of limited groups of neurons but that there is an identity in the functioning of patterns as a whole, these patterns "determined by the relations or ratios among the parts of the system and not by the specific neurons activated." (20)

According to Lashley, this means that there would be no limit to the kind or amount of transfer possible, since this nonspecificity would lead one to believe in general patterns rather than in special elements.

Subcortical Structures and the Neurons. Underneath the cerebral hemispheres lies the thalamus, and directly under this the enlargement of the spinal cord termed the "medulla." Ascending tracts pass through the cord and the medulla to centers in the thalamus, and from the thalamic centers to corresponding centers in the cerebral cortex. Descending tracts pass from the cortex through the thalamus to the cord, and from thence to the organs of response (Fig. 6).

In the region of the medulla oblongata and encircling it with some of its fibers lies the cerebellum. This organ is a correlating center of high order for impulses from the muscles, tendons, and joints. If a movement has been initiated in the cortex, the cerebellum acts as a central coordinating center. None of its activity ever becomes conscious. The cerebellum is concerned with the adjustment of large bodily movements, *i.e.*, with the adjustment of the body in space, and with general bodily coordination.

On each side of the central nervous system lie two bands of ganglia called the "sympathetic nervous system." These bands of ganglia have connection with the cord at every level through fibers entering the sensory ganglia. In addition to the two bands of ganglia on each side of the cord, there are distributed throughout the viscera other ganglionic masses which control the important visceral organs. There are also nerve plexuses from this system in the walls of the veins. The sympathetic nervous system is not directly under the control of consciousness, but it may be indirectly conditioned, as in the manner described in connection with the discussion of the secretion of the salivary glands and the digestive tract.

The nervous system as a whole is composed of centers and tracts. The centers consist of cell bodies and the non-myelinated ends of fibers, which are gray in color. The tracts are white. The white appearance is due to the myelin sheaths which surround the fibers. In the spinal cord the white matter lies on the outside and the gray on the inside. The form taken by the gray matter in the cord is butterfly-like in appearance. In the cerebral hemispheres the gray matter lies on the outside and the white within, thus presenting direct reversal of the appearance of the gray and white matter in the cord. The cells which go to make up the centers consist of a cell body with a nucleus and elongations of the cell matter called "fibers." These fibers are highly polarized. Those which bring impulses *to* the cell are called "dendrites"; those which transmit impulses *from* the cell are "axones." The dendrites differ in appearance with the different cells. In all cases they have a treelike branching form from which originated the name by which they are called. The length of a fiber ranges from less than an inch to

several feet, depending upon the center of which it is a part and the function of the cell.

The cells are divided into three classes: sensory cells, which lie in the ganglia outside the cord; motor cells, which lie in the ventral portion of the cord; and the correlating neurons, which transmit impulses to the various cord levels and brain areas. Students are often confused by the idea that this division of the cells applies to the cord alone. It is equally applicable to all of the tissue which composes the nervous system; that is to say, to the cortex, the thalamus, the medulla, and the cord. The sensory and motor cells are highly localized in the cord and in the brain. The sensory cells in the cord region lie in the ganglia just outside the cord but have their endings in the dorsal region of the cord. The motor cells are located in the ventral portion of the cord. In the brain the same arrangement of sensory and motor neurons holds for the most part. The distribution of sensory and motor centers in the cortex has been discussed fully in an earlier section. The sensory centers lie back of the fissure of Rolando.

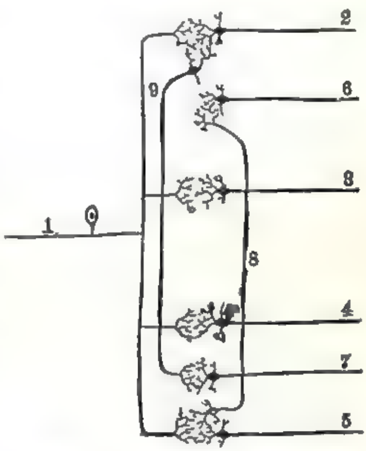


FIG. 7.—Diagram illustrating the indirect connection of afferent and efferent fibers by means of correlation neurones. (*H. A. Carr, "Psychology," Longmans, Green and Company, New York.*)

Though there are cortically controlled reflexes and reflexes from levels above the cord, much of the reflex action of the individual is controlled from the cord levels. An

impulse producing a simple reflex may come in through the sensory neuron to the dorsal horn of the cord and go from thence through a correlating neuron to a motor neuron, and out through the motor neuron to a muscle controlled at the same level of the cord as that at which the sensation came

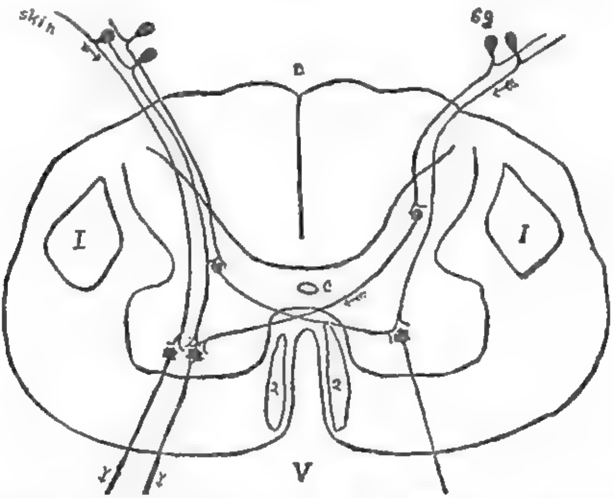


FIG. 8.—Cross section of the spinal cord. The inner H-shaped figure gives the outline of the gray matter. The remainder is white matter. *D*, dorsal; *V*, ventral; *sg*, spinal ganglion; *c*, spinal canal; *I*, *I*, are crossed pyramidal tracts containing fibers from the pre-Rolandic area of the brain; 2, 2, are direct pyramidal tracts carrying the same type of motor nerve fibers from the brain. The crossed fibers cross from one side to the other of the cord in the region of the medulla. The direct fibers cross at lower levels. The arrows indicate the direction of the nervous impulse. (*From Walter S. Hunter, "Psychology," University of Chicago Press, Chicago.*)

in. Practically no reflex action involves a single muscle, but a simple reflex may involve a group of muscles controlled from the same level. A reflex act involving a group of muscles at various cord levels would have the following path for an impulse originating in an organ for receiving sensations of pain, located on the surface of the skin: The organ

would be stimulated, and from thence the impulse would travel through the sensory ganglia lying outside the cord to the dorsal horn of the cord; from thence, by way of a correlating neuron, it would discharge into motor centers at the various cord levels, producing, for example, such a complicated response as jumping back from the source of the pain stimulus. Such a reflex action as this would involve all the levels which control the muscles of the legs and lower part of the trunk. It would be coordinated from the cerebellum.

The path of an impulse from an end organ in the skin which became conscious and which was responded to by a voluntary action would be as follows: It would travel from the receiving sense organ through the sensory ganglia lying outside the cord to the dorsal horn of the cord; thence by way of a tract to centers in the thalamus. From there it would go to that cortical area which receives sensations from the stimulated organ. From there the impulse would go to the various association areas and tie up with sensations of sight, with sensations of hearing, and so on. The impulse would travel across the corpus callosum, affecting both sides of the brain. It would go to the area lying just in front of the fissure of Rolando, and there by way of the pyramidal tract, which goes from the cells which control voluntary movement, it would travel to the area of the cord from which impulses to the desired movement would go out. For example, if the stimulus was a touch of an insect on the hand, the impulse would go to the area of the cord which controls the movement which the hand would take in brushing off the insect.*

It follows naturally from an analysis of the paths taken by an impulse in a simple reflex, in a reflex involving a

* See Fig. 9 for diagram of a simple response.

number of cord levels, and in an action which involves conscious control that there is an increase (*a*) in the number of levels involved and (*b*) in the amount of choice which

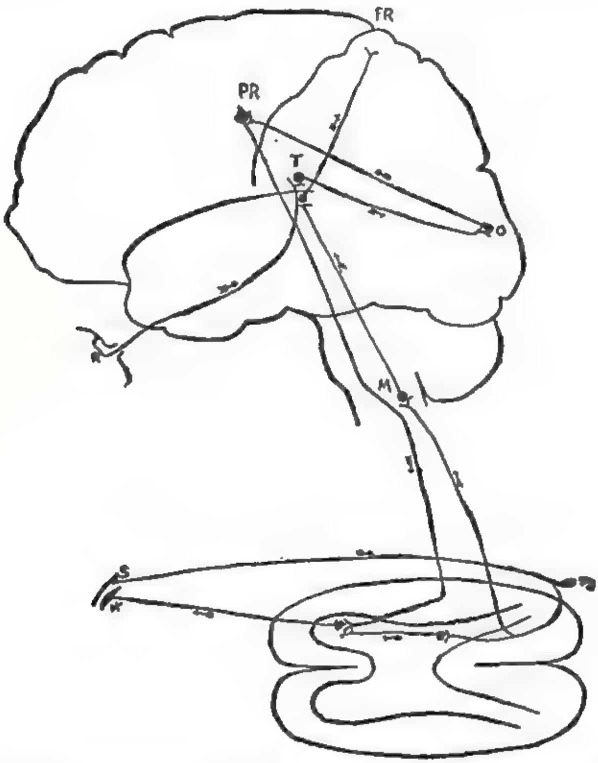


FIG. 9.—Probable pathway of a nerve impulse underlying a simple response. *R*, retina of eye; *T*, thalamus; *O*, occipital lobe; *PR*, preRolandic area; *M'*, muscle; *S*, skin; *sg*, spinal ganglion; *M*, medulla; *FR*, fissure of Rolando. (*From Walter S. Hunter, "Psychology," University of Chicago Press, Chicago.*)

enters into the reaction. An impulse resulting in a simple reflex has an almost immediate outlet in action; one which results in a reflex activity controlled from several cord levels is also relatively rapid; but an impulse which involves the

necessity for conscious choice of reaction requires a relatively long time to issue in movement, and may not issue in its final form for a period of months or even years. Some motor activity results whenever a sensation is experienced, but motor action which comes as a direct result of conscious experience, though accompanied by a slight amount of movement at the time of its reception, may be postponed until a number of other sensations have entirely modified the response which would have been given to the original sensation.

For example, the sight of the description of a prize contest, which will take place six months from date, may result in a resolve to take part in the contest. Such a resolve will lead to the gaining of a number of experiences, including a fund of knowledge in regard to the material which the contest involves. The final outcome of the first set of sensations, and the subsequent sensations to which the first have led, will not issue in the form of definite response until the contest itself takes place.

The neurons, or the nerve cells in the brain of the infant, consist in part of cell bodies with their nuclei. The bodies are all oval in shape, and their growth consists in the elongation of parts of the cell bodies to form the fibers previously described. The fibers may be either myelinated—*i.e.*, surrounded by a fatty sheath which appears to have as its function insulation—or they may be nonmyelinated. The developed fibers transmit impulses by means of the nonmyelinated ends; that is to say, at the synapses. Fibers appear to interlace in their polarized form; in other words, the dendrites of one fiber lie close to the axone brushes of the fibers from which they receive impulses. The points at which the ends of fibers overlap are called the "synapses."

The exact method of transmitting impulses at the synapses has not yet been clearly demonstrated.

The general mass of the brain is made up not only of nerve cells, though these constitute the only coordinating and controlling part of the mechanism, but throughout the brain there is connective tissue. The tissue of the brain, like all the other tissues of the body, is nourished by means of veins and arteries which are distributed throughout its entire area. The brain increases in weight from infancy to twelve years of age. The neurons develop in function over a period of years, the exact number of which has not yet been determined. Probably changes in the functional connections of neurons continue throughout the entire lifetime of the individual, except in the case of senile decay, where there appears to be an actual disintegration of the nervous tissue.

ORGANS OF RESPONSE

The organs with which children respond to stimuli can be grouped under three categories, the smooth muscles, the striped muscles, and the glands.

The Smooth Muscles. The smooth muscles are found mainly in the digestive tract and other visceral organs. They lie, for the most part, in the lower part of the esophagus, the stomach, and the large and small intestines. The smooth muscles are not directly under conscious control, but their responses can be so conditioned as to develop habitual methods of reaction to external stimuli. For example, the pattern of contraction in the presence of food which the child likes appears to be fairly well set; *i.e.*, there are a definite number of rhythmical contractions per minute. When the child is angry, the contractions cease. If food be presented at the same time that the anger state has been

set up by, say, slapping the child, and if this process be repeated over a long period, the mere presentation of the food at the end of the period will give rise to the anger reaction, and thence to the cessation of the movements of the stomach and intestines. Many conditioned reflexes such as the one just described are set up in connection with the smooth muscles. They are, therefore, organs of response which respond to education, and which are not secondary in importance to the other two groups of responding mechanisms.

The Striped Muscles. The striped muscles form the great mass of muscular tissue of the skeletal muscles. These are the muscles which have to do with those large and small movements of the body as a whole which are under conscious control. As illustrations of movements which are governed by the striped muscles, we might use walking, throwing a ball, jumping, running, and so on. Certain peculiarities in their structure give the tissues which make up these muscles the striped appearance from which they derive their name.

The Glands. *a. Duct Glands.* The duct glands constitute organs of response in almost the same sense as do the muscles, inasmuch as presentation of certain stimuli will produce or check the normal secretions peculiar to those glands. The principal duct glands which are found to be influenced by external stimuli are the salivary glands, the glands in the stomach, the skin, the pancreas, the liver, the lachrymal glands, and the kidney.

1. The Salivary Glands. There are three pairs of salivary glands in the mouth cavity: the parotid, the sublingual, and the submaxillary. These glands manufacture and

secrete saliva, a secretion which is poured directly through the ducts into the mouth. Food is moistened with this fluid during the process of chewing. Saliva acts upon the starch content of foods before they reach the stomach. The fluid has an alkaline reaction. Like the smooth muscles, the salivary glands do not seem to be directly under conscious control, but their activity may be changed by means of conditioned reflexes. For example, if a child be told, in the presence of a fresh vegetable such as spinach, that that food will be tasteless and he probably will not like it, but that he should eat it because it is good for him, the conscious condition set up may cause a diminution in the flow of saliva, although the child by direct will could hardly inhibit the flow of this secretion. Fear states are excellent illustrations of the manner in which the flow of saliva can be checked. In certain primitive countries it is the custom to feed rice to all persons suspected of a crime. The guilty man is supposed to be he who, when the rice is ejected from his mouth, has had no salivary secretion with which to moisten it and therefore ejects dry rice.

2. The Glands of the Stomach. Like the glands of the mouth, the stomach glands secrete a fluid necessary to digestion. The amount and kind of this secretion is not directly under conscious control; but it, too, is under the influence of indirect control such as that exercised on the salivary glands. For example, a fear state will produce a diminution or even a complete stopping of the flow of the digestive juices. Let some food be presented regularly with the feared object, and the presence of the food will in time have the same effect on the digestive juices. The experiments of Pavlov with the indirect control of the amount and kind of secretion of the gastric juices are too well known to need citation here, as are the later researches of Cannon.

3. Pancreas. The glands in the pancreas are not so well known in their relation to external stimuli. Such information as we have from the work of Pavlov indicates that there is some evidence that conditioned reflexes may be set up in connection with the secretions of these glands.

4. Liver. The liver is of especial importance inasmuch as it stores up glycogen, which is released in the form of blood sugar in anger and in fear states. Further discussion of the function of this organ will be found in the chapter on the Emotions.

5. Kidney. The function of the kidney is, for the most part, excretory in nature. The organ is of interest to psychologists largely because it, like the liver, is concerned to some degree in emotional states. The kidney will be discussed further in connection with work on the emotions and in the discussion of the conditional reflex in babies and young children.

6. The Lachrymal Glands. These are so situated as to open into the eye. The secretions which they discharge under strong stimulation are commonly called "tears." A constant flow of the secretions from these glands bathes the surface of the cornea. When foreign substances are introduced, and in emotional states, the secretions increase to such an extent as to appear as tear-drops. The activities of the lachrymal glands are subject to conditioning in the manner discussed in connection with the functioning of the salivary glands and the glands in the stomach.

b. Ductless Glands. The ductless or endocrine glands derive their name from the fact that they appear to have no external outlets. The substance manufactured by these

glands appears to be absorbed directly in the blood stream. Dysfunction of one or more of the ductless glands seems to have a profound effect both on the physical condition of children and on their behavior.

1. The Thyroid Apparatus. One of the chief endocrine organs is the thyroid, consisting of the two thyroids and four parathyroids. These are situated on both sides of the larynx. The thyroid vesicles are generally filled with viscid colloidal fluid. The secretion contains iodine; an imbalance in the secretion of this organ may often be controlled by the direct administration of iodine through the mouth. Removal of the thyroid, or lessened thyroid secretion, seems to produce the following symptoms; slowing down of the growth of the body as a whole, delay in the development of the generative organs, a deposit of fatty tissue, slowing down in mental development, thinning of the hair, paleness of the face, and dryness of the skin. A total lack of the thyroid secretion produces cretin idiocy. A somewhat similar picture is shown where atrophy of the gland has occurred in adulthood. There are many cases in which the disturbance of function merely results in an apparent lethargy and general dullness. In cases where disturbance takes the form of overactivity of the gland, the child shows a rapid pulse sometimes with some irregularity, nervous excitability, flushing of the skin, and increased perspiration. In these cases the body fat appears to be diminished rather than increased, as it is in the case of a secretion which is under normal.

2. The Parathyroids. The parathyroids are two small masses of glandular tissue embedded in the thyroid apparatus. In size and shape they resemble somewhat a grain of wheat. The removal of these structures produces

tetanus. Complete absence of the substance which they secrete produces a tetanic condition or extreme response to stimuli. These responses are convulsive in nature. The parathyroids seem to have some control over the amount of lime present in the body tissues.

In certain areas of the United States where there is disturbance of the functioning of the thyroid gland, the parathyroid also appears to be affected. The writer has the records of a number of cases who showed short periods of excellent behavior followed by violent temper tantrums in which they injured themselves or their families. In every one, X rays and other tests showed a shortage in parathyroid secretion. The feeding of parathyroid under a doctor's care, together with vitamin D or natural sunshine and large quantities of calcium-producing food, resulted in a complete change in behavior. These individuals became relatively even in emotional tension. They had neither violent spells of temper nor periods of relative inactivity, which their parents had previously termed "goodness."

Further study of the function of this gland in relation to behavior should produce valuable results.

3. The Adrenal Apparatus. The adrenal glands are attached to the kidneys. When both are removed, the body temperature becomes lower, the heartbeat becomes extremely weak, the pulse is feeble, and the blood pressure is markedly lower. In diseased conditions of the adrenal glands, there is a muscular weakness, a feeble heart action, a disturbance of the digestive tract, and the appearance of a bronze color in the skin. The adrenal glands are particularly interesting from the point of view of the psychologist in that the substance which they secrete, adrenalin, appears to be of great importance in anger and fear states.

4. The Pituitary Apparatus. The pituitary body is located in the region of the optic chiasma. It consists of two lobes, the functions of which appear to differ widely; removal or disease of both lobes produces death. Extracts from the posterior lobe appear to have a generally stimulating effect upon the smooth muscles and to some extent upon certain glands such as the kidneys and the mammary glands. Lack of secretion of the posterior lobe is accompanied by obesity and by an arrested development of the sex glands which results in sexual infantilism. Hyperactivity of the anterior lobe produces gigantism.

The writer has in mind a case in which the tendency to gigantism occurred in a five-year-old. The child, though five years mentally and five in social reactions, was as tall and as heavy as the average nine-year-old. Her motor control was still that of a five-year-old. This gave rise to great clumsiness, which was not understood by either her parents or her teachers. When brought to the mental-hygiene clinic she was stubborn, given to temper tantrums and screaming, and in general had developed into a serious problem both at home and at school. There are undoubtedly many similar cases.

5. The Sex Glands. The sex glands appear to play little part in the physical condition of the preschool-age child. They are, however, functioning to some degree, since it is not at all difficult to tell in most cases of three-year-olds whether one is observing a boy or a girl. The boys are beginning to show definite masculine characteristics and the girls those which cause them to be labeled feminine.

In an occasional case these glands are delayed in their functioning. Where this occurs it is difficult to tell the sex

of the child by outward appearance. The writer had one of these in a nursery group. The children customarily addressed him in some such fashion as the following: "He isn't ready to play, is she?" or "She has a new shirt, hasn't he?" indicating their confusion as to his sex.

These glands appear to be responsible for many of the physical changes which take place during the preadolescent and the adolescent periods; *e.g.*, the development of the secondary sexual characteristics seems to be dependent upon the substance which these glands secrete.*

The innate equipment listed in this chapter is common to all human beings. All stimuli will be received by the end organs, impulses will be transmitted to the nervous system, and from the nervous system impulses will be sent out which will cause the responding organs to react.

Bibliography

1. ANGELL, JAMES R.: "Psychology," Chaps. II, V, Henry Holt and Company, Inc., New York, 1908.
2. BARCROFT, J.: "The Brain and Its Environment," Yale University Press, New Haven, 1938.
3. BOLTON, J. S.: "The Cortical Localization of Cerebral Function," Oliver and Boyd, Edinburgh, 1933. The Henderson Trust Lectures, No. XII.
4. BRICKNER, R. M.: "An Interpretation of Frontal Lobe Function Based upon the Study of a Case of Partial Bilateral Frontal Lobectomy," in "Localization of Function in the Cerebral Cortex," Association for Research in Nervous and Mental Disease, The Williams & Wilkins Company, Baltimore, 1934. Series of Research Publications, Vol. XIII, pp. 259–351.

* There is so much question as to the function of the pineal gland that it has not been included in the list treated in the body of the text. It appears to have as its function some of the changes which lead to puberty. At adolescence it ceases to secrete and becomes filled with a calcareous substance called "brain sand."

5. CARMICHAEL, L.: "Fetal Behavior and Developmental Psychology," pp. 108–117, *Onzième Congrès internationale de psychologie*, 1938.

6. CARMICHAEL, L.: "Origin and Prenatal Growth of Behavior," in Carl Murchison, editor, "Handbook of Child Psychology," 2d rev. ed. pp. 31–159, Clark University Press, Worcester, 1933.

7. CARMICHAEL, L.: "The Response Mechanism," in E. G. Boring, H. S. Langfeld, and H. P. Weld, editors, "Introduction to Psychology," pp. 223–249, John Wiley & Sons, Inc., New York, 1939.

8. CARR, H. A.: "Psychology: A Study of Mental Activity," Chaps. II, III, Longmans, Green and Company, New York, 1925.

9. CHILD, C. M.: "Physiological Foundations of Behavior," p. 35, Henry Holt and Company, Inc., New York, 1924.

10. COGHILL, G. E.: "The Neuroembryologic Study of Behavior: Principles, Perspective and Aim," *Science*, **78**: 131–138, 1933.

11. DANDY, W. E.: "Changes in Our Conceptions of Localization of Certain Functions in the Brain," Abstract, *American Journal of Physiology*, **93**: 643, 1930.

12. FISCHEL, M. K.: "The Spastic Child: A Record of Successfully Achieved Muscle Control in Little's Disease," The C. V. Mosby Company, Medical Publishers, St. Louis, 1934.

13. FORBES, M. H. S., and H. B. FORBES: "Fetal Sensory Reactions—Hearing," *Journal of Comparative Psychology*, **7**: 353–355, 1927.

14. FRANZ, S. I.: "Cerebral-mental Relations," *Psychological Review*, **28**: 81–95, 1921.

15. GESELL, ARNOLD: "The Embryology of Human Behavior," Harper & Brothers, New York, 1944.

16. GIRDEN, E., F. A. METTLER, G. FINCH, and E. CULLER: "Conditioned Responses in a Decorticate Dog to Acoustic, Thermal, and Tactile Stimulation," *Journal of Comparative Psychology*, **21**: 367–385, 1936.

17. KASATKIN, N. I., and A. M. LEVIKOVA: "On the Development of Early Conditioned Reflexes and Differentiations of Auditory Stimuli in Infants," *Journal of Experimental Psychology*, **18**: 1–19, 1935.

18. KOFFKA, K.: "The Growth of the Mind: An Introduction to Child Psychology," trans. by R. M. Ogden, Harcourt, Brace and Company, New York, 1925.

19. LASHLEY, K. S.: "Brain Mechanisms and Intelligence," University of Chicago Press, Chicago, 1929.

20 LASHLEY, K. S.: "Experimental Analysis of Instinctive Behavior," *Psychological Review*, **45**: 445–471, 1938.

21. Lashley, K. S.: "A Simple Maze; with Data on the Relation of the Distribution of Practice to the Rate of Learning," *Psychobiology,* **1:** 353–367, 1918.

22. Lashley, K. S.: "The Relation between Cerebral Mass, Learning and Retention," *Journal of Comparative Neurology,* **41:** 1–58, 1926.

23. Lashley, K. S., and Josephine Ball: "Spinal Conduction and Kinaesthetic Sensitivity in the Maze Habit," *Journal of Comparative Psychology,* **9:** 70–106, 1929.

24. Marquis, D. P.: "Can Conditioned Responses Be Established in the Newborn Infant?" *Pedagogical Seminary and Journal of Genetic Psychology,* **39:** 479–492, 1931.

25. Pieron, H.: "Thought and the Brain," trans. by C. K. Ogden, Harcourt, Brace and Company, New York, 1927.

26. Ray, W. S.: "A Preliminary Report on a Study of Fetal Conditioning," *Child Development,* **3:** 175–177, 1932.

27. Sontag, L. W.: "Movement Response of the Human Fetus to Sound Stimuli," *Child Development,* **6:** 253–258, 1935.

28. Spelt, D. K.: "Conditional Responses in the Human Fetus in Utero," *Psychological Bulletin,* **35:** 712–713, 1938.

29. Terman, Lewis, and Maude A. Merrill: "Measuring Intelligence," Houghton Mifflin Company, Boston, 1937.

30. Tilney, F., and H. A. Riley: "The Form and Functions of the Central Nervous System. An Introduction to the Study of Nervous Diseases," Paul B. Hoeber, Inc., New York, 1923.

31. Watson, J. B.: "Psychology from the Standpoint of a Behaviorist," Chaps. III–V, J. B. Lippincott Company, Philadelphia, 1919.

32. Woodworth, R. S.: "Psychology," Henry Holt and Company, Inc., New York, 1940.

Chapter - - - - - - - - - - - - - - - - - Four

INNATE RESPONSES AND TENDENCIES TO RESPONSE

A. REFLEX AND RANDOM ACTIVITIES

Reflexes. There are a number of activities which function from birth, whenever stimuli adequate to cause them to occur are present, either within the organism itself or in the external environment. These responses occur in a more or less definite pattern and are common to all human infants. By far the largest portion of responses are concerned with physiological processes—breathing, heartbeat, movements of the digestive tract, secretion of the glands, and the like. The reflex responses other than those involved in the physiological processes appear to be relatively few in number. A catalogue of those which have been demonstrated to be present at birth or shortly after would include sneezing, crying, yawning, sucking, smiling, grasping, holding up the head slightly, turning the head if lying face downward, and certain defensive movements to be discussed later. The crawling reflex and the reflexes involved in walking are apparently inherited in regard to their general functioning, but are delayed in appearance and require practice in order to bring them to the point of perfection. The reflexes involved in crawling appear to be

particularly variable. One baby may hitch along by the use of one leg; a second may crawl on all fours; while a third may crawl on its hands and feet and approximate in its gait a four-footed animal. There appear to be countless variations of all three of these forms of crawling* (8, 19, 34, 41).

A recent contribution to research made by Dr. Myrtle McGraw (41) is the correlation of the development of specific cortical centers with the sequential development of behavior patterns. There is a definite change in the centers in the brain before walking is acquired. Myelineza-tion of the nerve fibers takes place to a large extent before these reflexes appear. Even a superficial examination of the nerve centers which are about to function shows this change. The work of Gesell on maturation as indicated by ease of and interest in learning of different types throws further light on the need for the preparation of specific centers before the activity controlled by those centers can be mastered.

The importance of the role played by maturation in learning and in development of all types is yet to be deter-mined. Recent researches have indicated that it plays a far larger part than we have hitherto suspected. Gesell (20) has given us some interesting results on the influence of maturation in learning to climb and in cube behavior. Twin T was trained daily in climbing and in cube behavior

* Burnside (8) has defined the three forms of locomotion in infants. According to her definition, crawling involves "any type of locomotion in which the body is prone on the floor." Creeping designates locomotion in which the body does not touch the floor but parallels it. Progression goes on by means of the hands and knees or hands and feet. Hitching is used to indicate "locomotion in a sitting position." We have used the term crawling here merely to indicate locomotion other than walking.

for 6 weeks. The training was begun at the age of 46 weeks. Twin C was not trained in these reactions until the end of 53 weeks at which time Twin C was given a 2-weeks training period in climbing. At 52 weeks, Twin T climbed the staircase in 26 seconds, while Twin C at the age of 53 weeks climbed the same staircase in 45 seconds and after 2 weeks training climbed it in 10. The climbing performance of the identical twin who was not trained was better than the same performance in the identical twin who was trained. Gesell states this advantage to be due to difference in maturity.

Similar results were obtained for cube behavior. In the emotional, expressional sphere in which training was also conducted, practically the same results were obtained. Maturation as a factor in learning has been far too little taken into account. It may well be that in such things as the school subjects, far less practice would be necessary and far more permanence attained if the material were presented at the level at which the connections necessary for its apprehension were developed. Such a program would probably entail an entire shift of subject matter. The question of the degree to which maturation plays a part is as yet mainly a theoretical one, but recent research has indicated the fertility of this field for the interpretation of the results of experiments on learning and development.

A list of the reflexes present at birth, presumably those for which the nerve connections are already laid down, follows.

Sneezing. According to Angelis (3), Watson (60), and others sneezing may occur even before the birth cry. Any object which tickles the nose internally or externally at the base of the nostril may produce this response. After

infancy it may be inhibited by direct control. It often becomes attached to stimuli other than contact sensations in or outside of the nose itself. For example, a cloud of dust seen through a window may cause sneezing though none of the dust itself touches the nose.

Yawning. Yawning may occur any time after birth. The stimulus is probably some change within the organism itself. The exact biological significance of this reaction cannot well be traced, though its purpose is probably the same in early childhood as in later life, *viz.*, the supplying of additional oxygen.

Sucking. Sucking occurs in response to a touch upon the lips. This may occur when the child is not hungry, but it is much more likely to occur when some need for food is present.

The Moro Reflex. This set of reflexes is often termed the "body-startle reaction." The number and kind of stimuli which set off this reaction differ somewhat with the condition of the baby. The child must be quiet before it can be called out adequately. If the child is relaxed the reaction is more marked than if he is tense. The strength of the stimulus determines to a large extent the magnitude of the reaction, but any stimulus which is strong enough to produce insecurity will bring it out. The fingers and thumb take a C position. The upper extremities are extended and the arms come together in front of the thorax. The lower extremities are sometimes extended and sometimes flexed. Movement is almost always bilateral and carried throughout the entire body at the same time. In a word, the movements appear to be completely synchronized. The Moro reflex present at birth is strongest

during the second month of life. It begins to diminish somewhat between the ninth and tenth weeks. The usual order of disappearance is, first, the extension without bowing of the upper extremities; then the C posture of the fingers disappears; and, finally, the body shows marked lessening of activity.*

Grasping. Whenever an object is placed in the hand, the grasping reflex is set up. If a strong rod be placed in the hands of the baby a few hours after birth, the baby may be lifted from the bed still clinging to the rod. Most babies can support their own weight, for lengths of time varying from a few seconds to over thirty seconds, within a few hours after birth. In abnormal cases, as, for example, general malnutrition and in illnesses of various kinds, this reflex may not be present. The grasping reflex disappears at about the time that the eye-hand coordination is developed. According to most authorities (3, 11, 21, 30, 40, 42, 53), this reflex is present and active to about the twentieth day or even longer. This reflex is of tremendous importance in the acquisition of early habits. The stimulus resulting from grasping the object becomes associated with the visual stimuli produced when the object is passed in front of the child's eyes in the random hand movements which occur so frequently in the early period of development. Grasping as an activity occurs throughout life. Reaching and grasping with the accompanying hand movements to the mouth are a part of the learned activities based on innate tendencies.

Blinking. Blinking first occurs when the eye itself

* See McGraw (40) for a complete description of the incidence and disappearance of this reflex.

is touched. Later, through conditioning,* this reflex occurs whenever an object approaches the eye. It may even occur in response to movements of objects far from the eye. Blinking, when objects approach the eye, is one of the best illustrations of the conditioned reflex. Originally aroused only when the eye itself is touched, this activity occurs in response to stimuli further and further from the eye and can finally be produced at a distance of some feet as, for example, when a ball is thrown in the direction of an individual, blinking may occur long before the ball is caught and held. A hammer approaching a glass a foot or more from the eye of the subject will produce blinking in the case of most adults.

Smiling. Smiling, like sneezing, appears to occur in response to both external and internal stimuli. A touch on the cheek, stroking, petting, and the like may cause this response, but equally it may occur when none of these stimuli is present. A recent study has given us the development of smiling in individual cases. A list of the stimuli cited by various investigators as producing this activity in the first year ranges all the way from stimulation of the erogenous zones, tickling, shaking and patting, intro-organic stimulation, gentle rocking, and turning on the stomach, as given by Washburn (59) through a similar list, as given by Dearborn, to washing in warm water and nursing, the causes cited by Major and Blanton, respec-

* The concept of conditioning is used here to denote the attachment of a response to a situation or a stimulus to which it has hitherto not been attached. One can, *e.g.*, condition a child who has hitherto entered a room without fear in such a manner that the opening of the door which leads into the room will produce a fear state. Equally, one can condition a child who has hitherto given evidence of avoiding reactions to milk or other nourishing food in such a way that the presence of the food will produce all of the reactions necessary to approach the food and eat it.

tively. There appears to be an increase in the number of social stimuli as against organic with increasing age, though until the second year authorities list, as causes of smiling, internal sensations and other purely physical causes. There appears to be a difference in the actual pattern of the reaction from infancy to the end of the first year (59).

Defensive Movements. According to most authorities (3, 11, 60), a light pinch on the nose produces a movement of the child's hand to the spot pinched, with pushing movements directed at the hand of the experimenter. A similar defense movement is found if the baby's leg is pinched while he lies on his back with legs extended. If the knee is pinched, the opposite foot is brought up to the spot pinched.

Turning the head occurs whenever the baby is placed face downward. This response would appear to be one of those protective responses necessary if the child is to survive during the short periods in which he is left alone. If this response were not present suffocation might occur when, through some chance, the baby was placed with his face buried in the sheet or pillow.

Hitching, Crawling, and Walking. Though there are no true hitching, crawling, or walking movements present immediately after birth, the movements on which these are based appear to occur to some degree. Pushing when the hand is placed against the foot may in time develop into the pushing movements of the foot against the ground. Exercise of the back and leg muscles which will be involved in walking is going on constantly. The entire walking coordination passes through definite states of development,

but these may vary both in their pattern and in the time at which they occur (8). In the first movements of locomotion, the abdomen remains in contact with the floor, crib, or other surface, and is pushed or dragged slowly. As the muscles mature, the abdomen is lifted and the weight supported between the arms and legs. Some children sit and hitch along where others walk not on the knees and hands but on the feet and hands in the manner of quadrupeds. According to Burnside, progression seems to proceed in line with the removal of point after point of contact with supporting surfaces until the child walks erectly with its entire weight supported by the two feet. The arms and other portions of the body still, however, take part in the balancing processes. Any observer who has studied the running movements of young children will note the enormous amount of movement also present in the arms and hands and the degree with which balance is maintained by these hand and arm movements. Gesell (17) puts crawling at four months in 85 to 100 per cent of cases and creeping at nine months in 65 to 84 per cent. Stepping movements, he states, may appear at nine months in 65 to 80 per cent. According to Variot (58), 67 per cent of children walk at from eleven to fourteen months of age. Gesell (17), in his more complete analysis of the acquisition of this complicated coordination, states that 20 to 49 per cent of the infants stand with help at nine months; 85 to 100 per cent at twelve months. The same author states that standing alone appears in 20 to 49 per cent of the cases at twelve months, and in 85 to 100 per cent of the cases at eighteen months.

Random Movements. In addition to the reflex responses, there are present at birth many random movements of the head, arms, legs, feet, and trunk. Later, movements

of the vocal cords, equally random, produce the sounds on the basis of which the speech coordinations are developed.

Random movements appear to be general in their character and to occur when the infant is responding to any sort of stimulus for which there is not a definite reflex for response. The child lying comfortably in his crib will make many movements of the facial muscles and will kick or move his arms about. These random movements appear to be preparatory to gaining voluntary control over the elements involved in all later activities. They often lead to the child's gaining more knowledge of himself, as, for example, the random movements of the legs which result in the foot's touching the hand. The grasping reflex set up by this touch gives the child a group of sensations which results in his tying up the foot as a part of his own body. A still greater group of sensations arises when the child in his random play with his foot succeeds in getting part of it into his mouth. The writer has several times noticed what appeared to be the baby's first successes in getting the foot into his mouth. The facial expression which follows upon the contact of the mouth with the foot shows the child's interest and delight.

Reflex and random movements are called into play whenever there are no set responses to the stimuli presented. If one leans over the baby, the sight of one's face will cause all sorts of movements. The baby grimaces, beats the air with his arms and legs, gurgles or makes equally inarticulate sounds, moves his head and trunk, and so on. From this mass of movement, apparently purposeless, will be selected reaching with the arms to be taken up when the mother appears, vocalizing such terms as "Mama," "Dada," and the like, sitting erect, pulling himself to a

standing position, and similar coordinated activities. Practice and success will select from the mass of uncoordinated activities those activities which will best serve to meet new situations. Reaching out the arms will cause the baby to be lifted from the crib; calling "Mama" will get him attention; sitting and then standing erect will both increase his range of vision and bring new objects within reach of his hands and arms.

On the basis of these reflexes and random movements, the child develops the whole range of muscular coordinations with which he meets the later demands that present-day society puts upon him. A great number of activities have been learned by the end of the first year of life (17 to 21).*

An individual peculiarity of response, which was previously thought to be the result of direct inheritance, has recently been the subject of investigation. Watson has given us an extended series of experiments bearing on the tendency of the child to prefer the right or the left hand. Specific methods were used in studying this problem. The first consisted of measuring right and left anatomical structures, such as the width of the palm and wrist, and the length of the forearm. According to Watson, measurements of several hundred children showed no significant difference between the right and the left arm, wrist, and palm. The second lay in making a record of the length of time during which the baby could suspend himself with the right and with the left hand. There appears to be no constant difference between right and left hand in this test. The third experiment consisted of making a record of the

* See also GESELL, ARNOLD, "The First Five Years of Life," Harper & Brothers, New York, 1940.

Lippman (36), in a series of investigations directed toward another field, found that there was no hand preference in the subjects studied to four and a half months of age. Hand preference appeared between four and a half and twelve months of age. At twelve months, 70 per cent + use of the right hand was found. Such figures may indicate that handedness is the result of maturation and that studies of behavior patterns in early infancy in which no preference was found merely indicate that hand preference has not yet developed.

Such results as those of Giesecke (22) indicate that either the right or the left hand may be preferred. In a series of studies on right-left and left-right transfer in maze learning we found (4) that the average child who learned a maze with his right hand had a complete transfer to the left, whereas the average child who learned with his left had a complete transfer to his right. Three trials or less is all that is necessary with the untrained hand. One hundred per cent transfer occurred in 90 per cent of these cases. Twenty per cent of our cases were, however, preferentially right-handed, and in these not only did transfer fail to take place but training the left hand first actually interfered with training the right hand in the same maze. Eight per cent of our cases were definitely left-handed and these too showed no transfer from training the left hand to skill with the right; on the contrary such training interfered. The results of Hicks,* who found 96 per cent right-hand preference in throwing balls at a moving target in children two to six years, and those of Jenkins,* whose 300 subjects

* For a discussion of these results see J. A. Hicks, "The Acquisition of Motor Skill in Young Children: An Experimental Study of the Effects of Practice in Throwing at a Moving Target," *University of Iowa Studies in Child Welfare* IV, No. 5, 1931, and L. Jenkins, "A Comparative Study of

showed 85 to 90 per cent right-hand preference, appear to contradict the results of both Lippman (36) and our laboratory. This difference in results is probably due to the fact that Hicks and Jenkins used children, the majority of whom were more than four years of age, at which time education has often been able to overcome such cases of preference in handedness as were susceptible to training.

It is highly probable that all these results may be taken to indicate the possibility that right- and left-handedness, like other characteristics, are distributed in the form of the normal distribution curve, *viz.*, if the curve represents 99.73 per cent of the cases and the base line is divided into five equal parts the cases would fall as follows: 3 per cent definitely left-handed, 22 per cent preferring the left hand, 50 per cent ambidextrous, 22 per cent with a right-hand preference, increasing as the cases range toward the top 3 per cent, and 3 per cent definitely right-handed and incapable of conditioning to much use of the left hand. Experiments on adults tend to add weight to this supposition. A large proportion of adults who are supposed to be right-handed use their left hands frequently, sometimes as frequently as they do their right. Society has conditioned them to the belief that right-handedness is preferred and they therefore believe themselves to be right-handed, a belief which their activity actually does not substantiate.

If the theory as presented is correct, it would account for the fact that a number of children can be conditioned

---

Motor Achievements of Children Five, Six and Seven Years of Age," *Teachers College Contributions to Education*, No. 414, Teachers College, Columbia University, New York, 1930.

to be more or less right-handed but that there is a proportion to whom such conditioning is impossible.

Bryngel Bryngelson (7), in a study of 900 cases of true left-handedness in which an attempt had been made to force the child into a right-handed pattern, found 900 cases in which there had been definite interference with reading or writing or speech. In some cases all three showed definite abnormalities or blocking. Theoretically these cases would constitute the top 3 to 5 per cent of the distribution curve.

Research has failed to show cases in which left-handedness allowed to develop naturally has resulted in any pathological symptoms whatever. On the contrary, there are instances of leaders in all fields of athletics, except golf, whose left-handedness has been an asset. Eventually in golf, too, a left-handed champion will probably develop.

Watson's point of view that all children can be conditioned to be right-handed is open to question on the basis of all the results presented herewith. It would be safe to say that no child who shows a strong left-hand preference should ever be conditioned to use the right hand except perhaps in handling table utensils. Such researches as those of Bryngelson (7) make it clear that the damage resulting from such conditioning is far too serious for any psychologist or psychiatrist to put himself in the position of advising reconditioning left-handed children. Even in cases with slight left-hand preference authorities seem agreed that conditioning should not be done after the sentence stage in speech has been reached, except by the advice of a specialist and under his care. There seems to be so close a relation between speech and hand movements

that interference with left-handedness after the speech coordinations are fairly well developed may produce some forms of speech defect. A case of such interference with speech in a left-handed four-year-old was recently reported to the writer by the specialist in charge of the case. The boy had spoken easily until at four his family suddenly began to insist on the use of the right hand at the table and at such other times as the child was with them. Stammering developed shortly afterwards, with the result that the child was taken to a specialist in speech work. The parents were advised to stop all attempts to make the boy use his right hand in preference to his left, and the speech trouble disappeared almost as suddenly as it had developed.

The physiological processes compose, as has been stated, by far the largest proportion of the pattern responses present at birth. Except under abnormal bodily conditions, these reactions go on in a uniform way. There is so little variation among individuals regarding the physiological processes that one can lay down rules as to the pulse rate, the number of respirations per minute, and so on, which will apply more or less uniformly to all human individuals. Changes in the secretions of the glands, changes in the distribution of the blood, the secretions of the digestive tract, and the like are under conscious control only insofar as they may be indirectly conditioned in the manner pointed out in the discussion of the organs of response in Chap. III.

The breathing rate may be consciously controlled for a short period. The excretory processes are directly under conscious control, since these may be inhibited over long periods. The methods by which these come under control are interesting illustrations of the usefulness of the con-

ditioned reflex in training young children. At first, defecation and urination occur involuntarily, as soon as pressure is felt in the organs which control these processes. A chart is made of the times at which these processes occur. At the intervals suggested by the charts the child is placed in position in the chair. Soon the visual and cutaneous stimuli which are present when the child is seated on the chair serve as stimuli adequate to initiate these processes, provided that the regular intervals suggested by the chart are observed. The processes of defecation and urination occur when the chair situation is present, and do not occur when it is not present. If the training has been carried out irregularly, or too many additional stimuli surround the chair situation, or if the excretory processes are inhibited by scolding so that the chair situation comes to be associated with scolding instead of with excretion, these reflexes are not conditioned until late in the child's life. If the training is begun too late, say after two, it is very difficult to condition the reflexes involved in excretion. Conditioning should be begun during the first year.

EXERCISE

Observe the behavior of an infant under six months of age. What types of movements appear to be present?

List all movements which the baby makes during a period of fifteen minutes.

Touch the lip of the baby and note the response.

Put your finger against the palm of the baby's hand and note response.

List the causes of smiling.

Hold a ball or some other bright object directly in front of the baby and list the number of movements which the presence of this object calls out.

Perform a similar series of experiments with the subject whom you are studying.

Compare the responses of the baby with those of the child whom you have selected as the subject for your case study.

Bibliography

1. Aldrich, C. A.: "A New Test for Hearing in the Newborn: the Conditioned Reflex," *American Journal of Diseases of Children*, **35**: 36–37, 1928.
2. Anderson, John E.: "Child Development and the Interpretation of Behavior," *Science*, **83**: 245–252, 1936.
3. Angelis, F. D.: "Reflexes of the Newborn," *American Journal of Diseases of Children*, **26**: 211–215, 1923.
4. Arlitt, Ada Hart: "Some Experiments on Transfer of Training," Ohio Academy of Science, 1939.
5. Bayley, N.: "Mental Growth During the First Three Years. A Developmental Study of 61 Children by Repeated Tests," *Genetic Psychology Monographs*, **14**: 1–92, 1933.
6. Bryan, E. S.: "Variations in the Responses of Infants During First Ten Days of Post-natal Life," *Child Development*, **1**: 56–77, 1930.
7. Bryngelson, Bryngel, and T. Clark: "Left Handedness and Stuttering," *Journal of Heredity*, **24**: 387–390, 1933.
8. Burnside, Lenoir H.: "Coordination in the Locomotion of Infants," *Genetic Psychology Monographs*, Vol. 2, No. 5, 1927.
9. Carlson, A. J., and H. Ginsburg: "The Tonus and Hunger Contractions of the Stomach of the Newborn," *American Journal of Psychology*, **38**: 29–32, 1915.
10. Carmichael, L.: "A Re-evaluation of the Concept of Maturation and Learning as Applied to the Early Development of Behavior," *Psychological Review*, **43**: 450–470, 1936.
11. Chaney, L. B., and M. B. McGraw: "Reflexes and Other Motor Activities in New-born Infants: A Report of 125 Cases as a Preliminary Study of Infant Behavior," *Bulletin of the Neurological Institute*, **2**: 1–56, 1932.
12. Dennis, Wayne, and M. G. Dennis: "The Effect of Cradling Practices upon the On-set of Walking in Hopi Children," *Journal of Genetic Psychology*, **56**: 77–86, 1940.
13. Dewey, E.: "Behavior Development in Infants," Columbia University Press, New York, 1935.
14. Dubnoff, B.: "A Comparative Study of Mental Development in Infancy," *Journal of Genetic Psychology*, **53**: 67–73, 1938.

15. FORBES, M. H. S., and H. B. FORBES: "Fetal Sensory Reactions—Hearing," *Journal of Comparative Psychology*, **7**: 353–355, 1927.

16. FREUDENBERG, E.: "Der Morosche Umklammerungsrefex und das Brudzinskische Nackenzeichen als Reflexe des Sauglingsalters," *Munchen medizinische Wochenschrift*, **68**: 1646–1647, 1921.

17. GESELL, ARNOLD: "The Mental Growth of the Pre-school Child," The MacMillan Company, New York, 1925.

18. GESELL, A., C. S. AMATRUDA, B. M. CASTNER, and H. THOMPSON: "Biographies of Child Development, the Mental Growth and Careers of Eighty-four Infants and Children," Paul B. Hoeber, Inc., New York, 1939.

19. GESELL, ARNOLD, and L. B. AMES: "The Ontogenetic Organization of Prone Behavior in Human Infancy," *Journal of Genetic Psychology*, **56**: 247–263, 1940.

20. GESELL, ARNOLD, and H. THOMPSON: "Learning and Growth in Identical Infant Twins," *Genetic Psychology Monographs*, Vol. 6, No. 1, July, 1929.

21. GESELL, A., H. THOMPSON, and C. S. AMATRUDA: "Infant Behavior: Its Genesis and Growth," McGraw-Hill Book Company, Inc., New York, 1934.

22. GIESECKE, M.: "The Genesis of Hand Preference," *Society for Research in Child Development Monographs*, **1** (5): 1–102, 1936.

23. GOLDSTEIN, K.: "Die Lokalisation in der Grosshirnrinde nach den Erfahrungen am kranken Menschen," in "Handbuch der Normalen und Pathologischen Physiologies," vol. X, pp. 600–842, Verlag Julius Springer, Berlin, 1927.

24. GOLDSTEIN, K.: "The Significance of the Frontal Lobes for Mental Performances," *Journal of Neurology and Psychopathology*, **17**: 27–40, 1936.

25. GUERNSEY, M.: "A Quantitative Study of the Eye Reflexes in Infants," *Psychological Bulletin*, **26**: 160–161, 1929.

26. HALVERSON, H. M.: "Studies of the Grasping Responses of Early Infancy: I," *Journal of Genetic Psychology*, **51**: 371–449, 1937.

27. HERRICK, C. J.: "An Introduction to Neurology," 2d ed., W. B. Saunders Company, Philadelphia, 1921.

28. HERRICK, C. J.: "Neurological Foundations of Animal Behavior," Henry Holt and Company, Inc., New York, 1924.

29. HOOKER, D.: "Early Fetal Activity in Mammals," *Yale Journal of Biology and Medicine*, **8**: 579–602, 1936.

30. HOOKER, D.: "The Origin of the Grasping Movement in Man," *Proceedings of the American Philosophical Society*, **79**: 597–606, 1938.

31. Honzik, M. P.: "The Constancy of Mental Test Performance During the Pre-school Period," *Journal of Genetic Psychology*, **52**: 285–302, 1938.
32. Irwin, O. C.: "The Amount and Nature of Activities of Newborn Infants Under Constant External Stimulating Conditions During the First Ten Days of Life," *Genetic Psychological Monographs*, **8**: 1–92, 1930.
33. Irwin, O. C.: "Infant Responses to Vertical Movements," *Child Development*, **3**: 167–169, 1932.
34. Irwin, O. C., and A. P. Weiss: "A Note on Mass Activity in Newborn Infants," *Journal of Genetic Psychology*, **38**: 20–30, 1930.
35. Irwin, O. C., L. A. Weiss, and E. M. Stubbs: "Studies in Infant Behavior, I," *University of Iowa Studies in Child Welfare*, **9** (4): 1–175, 1934.
36. Lippman, H. S.: "Certain Behavior Responses in Early Infancy," *Pedagogical Seminary and Journal of Genetic Psychology*, **34**: 424, 1927.
37. McGinnis, J. M.: "Eye-movements and Optic Nystagmus in Early Infancy," *Genetic Psychology Monographs*, **8**: 321–430, 1930.
38. McGraw, Myrtle B.: "The Moro Reflex," *American Journal of Diseases of Children*, **54**: 240–251, 1937.
39. McGraw, Myrtle B.: "Neural Maturation as Exemplified in Achievement of Bladder Control," *Journal of Pediatrics*, **16**: 580–590, 1940.
40. McGraw, Myrtle B.: "Neural Maturation as Exemplified in the Reaching-Prehensile Behavior of the Human Infant," *Journal of Psychology*, **11**: 127–141, 1941.
41. McGraw, Myrtle B.: "Neuro-Muscular Maturation of Anti-gravity Mechanisms as Reflected in the Development of a Sitting Posture," film, Normal Children Development Study, Columbia Medical Center, New York, 1940.
42. McGraw, Myrtle B.: "Suspension Grasp of the Human Infant," *American Journal of Diseases of Children*, **60**: 799–811, 1940.
43. Marquis, D. P.: "Can Conditioned Responses be Established in the Newborn Infant?," *Journal of Genetic Psychology*, **39**: 479–492, 1931.
44. Moro, E.: "Das erste Trimenon," *München medizinische Wochenschrift*, **65**: 1147–1150, 1918.
45. Myers, G. C.: "Infants' Inhibition: A Genetic Study," *Pedagogical Seminary*, **29**: 288–301, 1922.
46. Pratt, K. C.: "Generalization and Specificity of the Plantar Response in Newborn Infants. The Reflexogenous Zone: II. Segmental Patterning of Responses," *Journal of Genetic Psychology*, **45**: 22–38, 1934.

47. Pratt, K. C.: "The Organization of Behavior in the Newborn Infant," *Psychological Review*, **44**: 470–490, 1937.

48. Pratt, K. C., A. K. Nelson, and K. H. Sun: "The Behavior of the Newborn Infant," Ohio State University Press, Columbus, 1930.

49. Ray, W. S.: "A Preliminary Report on a Study of Fetal Conditioning," *Child Development*, **3**: 175–177, 1932.

50. Richards, T. W.: "The Importance of Hunger in the Bodily Activity of the Neonate," *Psychological Bulletin*, **33**: 817–835, 1936.

51. Richards, T. W., and O. C. Irwin: "Plantar Responses of Infants and Young Children: An Examination of the Literature and Reports of New Experiments," *Univeristy of Iowa Studies in Child Welfare*, **11** (1): 1–146, 1935.

52. Ricter, C. P.: "The Grasping Reflex in the New-born Monkey," *Archives of Neurology and Psychiatry*, **26**: 784–790, 1931.

53. Ricter, C. P.: "The Grasp Reflex of the New-born Infant," *American Journal of Diseases of Children*, **48**: 327–332, 1934.

54. Sherman, Maudel, and I. C. Sherman: "Sensori-Motor Responses in Infants," *Journal of Comparative Psychology*, **5**: 53–68, 1925.

55. Sherman, Maudel, I. C. Sherman, and C. D. Flory: "Infant Behavior," *Comparative Psychology Monographs*, **12** (59): 1–107, 1936.

56. Shirley, M. M.: "The First Two Years: A Study of Twenty-five Babies, Vol. I: Postural and Locomotor Development," *Institute of Child Welfare Monograph Series*, No. 6, University of Minnesota, Minneapolis, 1931.

57. Sontag, L. W., and R. F. Wallace: "The Movement Response of the Human Fetus to Sound Stimuli," *Child Development*, **6**: 253–258, 1935.

58. Variot, G.: "Sur les facteurs normaux et morbides qui peuvent avancer ou retarder le début de la marche bipède chez les jeunes enfants," *Bulletin*, Mem. soc. Med. Hop. Paris, **43**: 353–361, 1927. Cited from *Child Development Abstracts*.

59. Washburn, R. W.: "A Study of the Smiling and Laughing of Infants in the First Year of Life," *Genetic Psychology Monographs*, **6** (5, 6): 460–465, 1929.

60. Watson, J. B.: "Psychology from the Standpoint of a Behaviorist," p. 241, J. B. Lippincott Company, Philadelphia, 1919.

61. Weiss, L. A.: "Part I. Differential Variations in the Amount of Activity of Newborn Infants Under Continuous Light and Sound Stimulation," Irwin, Weiss, and Stubbs: Studies in Infant Behavior I, *University of Iowa Studies in Child Welfare*, **9** (4): 9–74, 1934.

INNATE RESPONSES AND TENDENCIES TO RESPONSE

B. INSTINCTIVE TENDENCIES

FOR MANY YEARS A CONFLICT HAS RAGED AROUND THE concept of instinct without arriving at any conclusions beyond the following: (*a*) that there are motivations for behavior, some learned and some unlearned; (*b*) that animals are less educable and more under the control of instincts than is man; and (*c*) that while the word "instinct" is open to misinterpretation the adjective "instinctive" may be used loosely as a substitute for the noun "motivation." All these contentions are relatively unimportant in view of the actual studies of the behavior of infants and young children. McGraw (15), Dennis (5), Sherman (18), Goodenough (8), Curti (4), and innumerable other experimenters have demonstrated the presence of motivations which are common to all infants no matter what term is used to designate them.

It is clear, however, that these motivations operate not in terms of a series of definite and clear reactions but rather as general stimuli to behavior. The physical constitution of the infant or young child, his heredity, previous experience with the stimulus, general environmental conditions,

level of intelligence, and health all operate to determine the type of response with which the individual meets situations. That he resists overdomination, likes to be in groups rather than alone, has a general drive to experiment or play with material, and tends to do as others do is too obvious to need argument or demonstration. It seems wise to continue to use the term "instinctive" rather than the less easily written and less comprehensible terminology "motivations common to all infants."

Because of his physiological structure as a human infant, *i.e.*, because of the fact that his is a human nervous system, the baby inherits these tendencies or drives to action which will be referred to as the "instinctive" tendencies. The patterns for these activities and tendencies to activity are neither so fixed as to the stimuli which call them forth nor so specific in their action as are the simple reflexes. Each instinctive tendency, when called into play, involves a number of adjustments. Within a short time after birth, these adjustments involve so much that might be called learned or partially learned responses that it is difficult to separate the learned from the unlearned element. The place of these tendencies as a basis for the formation of certain habits and the result of differences in the environment upon the types of habits developed will form the major part of our discussion.

The importance of these tendencies in behavior is indicated by the fact that whole systems of psychology have been built around them as a group or around specific drives such as sex and self-assertion. MacDougall's (14) concept of social psychology is based on instinctive tendencies interpreted as drives.

Freud's (7) whole system of psychoanalysis is derived from his interpretation of the manifestations of the sex instinct, while Adlerian psychology (1) is based on the functioning of the drive to self-assertion. The whole concept of the organization of and stimuli to the development of behavior problems, as well as the whole conduct of man, is to Freud largely controlled by sex in its normal and pathological functioning, while Adler interprets behavior problems as wrong channeling of the drives underlying self-assertion. To the latter author all life activity, whether successful or unsuccessful, with its coordinate results social adjustment or social maladjustment, is based on aggressive or defensive reactions.

Watson (20) denies that any activity is connected with a general drive and makes all behavior the result of specific activities present at birth. The acceptance of Watson's concept would make a study of children's behavior relatively easy. It is far simpler to observe overt activity and its conditioning than it is to interpret the action of drives not so specific and not so clear as to the stimuli which motivate their attachment and detachment to more or less specific objects and situations. Watson's "instinctive tendencies" may usually be reduced to earlier lists of overt reflex activity and to physiological reflexes together with some acquired habit patterns. Whatever point of view is taken as to instinctive tendencies, reflexes, and the random activities present at birth, no student of human behavior can fail to note the presence of certain behavior patterns in children of all races and people so far studied. To fail to take account of these is to leave a mass of motivations and their correlated activities which must be explained in a less adequate and less satisfactory manner. In fact such

explanations frequently leave the realm of science for that of speculation and philosophy.

The instinctive tendencies which appear to be present in all human young are the tendency to self-assertion; the tendency to do as others do; the tendency to become uncomfortable at the sight of suffering; play, which involves manipulation and experimentation with every object within the child's reach, including his own limbs and body; sex;* and gregariousness.* All other so-called "instinctive" activities can be grouped under these categories. The emotions present in early infancy are fear, anger, and love.

Self-assertion. The activities which come under the instinctive tendency to self-assertion can be classified under four headings: (*a*) defensive reactions to things; (*b*) defensive reactions to persons; (*c*) aggressive reactions to things; (*d*) aggressive reactions to persons. Under these headings can be listed such behavior as rivalry and emulation, display, the tendency to attract attention, bossiness, bullying, and teasing.

Defensive movements which occur as a part of this instinctive tendency are found in the very young child. Attempts to interfere with the child's movements, as, for example, to hold his arms, often result in pushing movements, accompanied in many instances by anger. The reaction of pushing against obstructions continues throughout the life of the child, though the degree to which it persists is somewhat dependent upon the treatment which the child receives. Against things which constitute ob-

* The responses which arise in connection with the functioning of these two groups of instinctive tendencies play an increasingly great part as the child matures, but they function but little in infancy.

stacles to the child's desire or to his activities, he reacts by putting forth immense effort and by making every possible movement which will result in the removal of the obstacle. This applies to all situations. It is a common thing to see young children take great delight in pushing and pulling objects which are much too heavy to be moved by their own strength. It is an equally common thing to see them pushing at and striking individuals who attempt to thwart their desires.

Any situation or object which inhibits movement or the free flow of thought and which cannot be removed by defensive movements produces first anger and then fear. A child who is closed in a room from which there is no escape, especially if the room is very small, reacts with anger and pounding. If he is unable to open the closet door or otherwise defend himself, fear almost certainly follows. A child unable to master the meaning of commands or of a lesson or a reading assignment reacts in the same manner. This drive to self-assertion is one of those whose manifestations may be transitory. If defense movements never result in success the individual may lose this drive and allow himself to be controlled by his environment instead of exercising control over it. The kindergarten-age child who can be moved about at will, forced into clothes which are too tight for him, or pushed back into his chair or into a corner is so governed by his environment that he may develop a complete lack of resistance to external pressure and thereafter reflect the attitudes, opinions, and social standards of each person with whom he comes in contact without any struggle for self-expression. Such behavior will be discussed more fully, particularly in connection with escape and defense mechanisms.

Behavior problems developed on the basis of the child's inability to defend himself from objects and situations too heavy, too strong, or too restricted for him ever to expect success are all too common. Children of inferior mentality given books which they cannot master and placed in a schoolroom from which they can neither escape nor gain a feeling of success defend themselves by any means which they are able to discover. Such children show one serious social maladjustment after another, from breaking up furniture and damaging the book which they cannot learn to lying, stealing, and cruelty. Defense reactions against insuperable objects may also involve defense reactions against persons.

Defense reactions against persons are present throughout life. Against the adult who attempts to interfere with his play or with activities in which he is interested, the child reacts with immediate defense movements or with some other form or forms which he has found to be effective in putting a stop to interference with his activities. A child who is constantly nagged and surrounded by an atmosphere in which "Don't" is the prevailing tone will often develop a general contrariness, which will show itself in opposition to anything which the adult in whose care he is suggests to him.

One case, a little boy, aged two, refused to do anything that was suggested to him. His response to an attempt to enforce authority was pushing and screaming. When the little boy entered the nursery school, suggestions from an adult were met with a flat "No," often accompanied by screaming and tears. When the adult's back was turned, the child would interfere with other children, pulling hair, biting, and generally making himself objectionable. The child's attitude had come about as the result of too much

repression. The treatment which was used in this case was to put the child where there were a number of interesting toys and to watch his activities to see wherein his main interests lay. He was not interfered with in any way so long as he was not interfering with the other children in the group. When he began to tire of what he was doing and to interfere with the other children, the suggestions which came from the adults as to what he could do next were along his line of observed interests. For example, he was known to have found interest in playing with the water toys, in washing his hands, and in mopping the floor. Another of his interests was in making a slide down which he rolled trains. One of these activities was suggested whenever the boy was doing things which were undesirable. After a prolonged period, in which outlets for activity were substituted for continual interference, the contrariness diminished noticeably. The result was achieved solely because a study of his interests was made, and as a result of this study interesting activity was substituted for one of his more asocial ones. Moreover, the boy was not interfered with unless what he was doing was actually disadvantageous to himself or to some other children in the group. Less interference and more outlets for activity also characterized his life at home. Contrariness and temper tantrums are frequent methods of defense reactions to too great an interference with children's activities.

Wherever too much repression, overcontrol, or constant nagging is present, children tend to react defensively. They find the weakest point in the parent's armor and direct their reactions toward that point. A child who feels that his success in school is essential to the happiness of a nagging or too authoritative parent may use failure

in his studies as a means of hitting back. A number of authors* have stated that temper tantrums, incorrigibility of various kinds, and even enuresis may develop on this basis alone. Much of otherwise inexplicable human behavior can be explained in terms of defensive reactions against persons and situations.

Defense reactions against persons take much the same form as those against objects that appear to hem the child in, to interfere with his movements in any way, or to block the carrying out of his purposes or plans. The reactions may become as violent when the child's arms are held too tightly by his clothes as when his hands are held too tightly by an adult or another child. Defense reactions are essential if a child is to develop normally. They are blocked when he faces insuperable obstacles. In the presence of complete blocking, anger usually appears first, to be followed rapidly by fear, if the additional energy furnished by anger is not sufficient to overcome the obstacle or to destroy it. A child who cannot get through a glass door may kick in the pane of glass. If the door is solid wood, he usually kicks or pushes to remove the obstacle, then becomes angry and reacts more violently. If no results then occur, fear appears. In situations of this type the same sorts of defense and escape reactions associated with fear and anger (see Chapters Six and Seven) appear. The pattern follows that discussed in connection with these two emotions. Since the drive has now been followed by emotions, it no longer functions and the emotions take its place.

Like other instinctive drives, defense and aggression are transitory. They may disappear entirely and the indi-

* See particularly *Bulletin of the Menninger Clinic*, Topeka, Kansas, Pediatric Issue, Vol. 8, No. 6, November, 1944.

vidual become helpless in the face of obstacles or blocking, or another type of response may be substituted. If, when the child attempts to push against an obstacle himself, he is immediately assisted by an adult or older child, he soon loses his tendency to overcome the obstacle by his own efforts and substitutes instead, as a response, going to some adult or other child and asking to have the thing done for him. This sort of behavior is very common among children who are too completely surrounded by adults whose business it is to minister to their wants.

Aggressive reaction to things can be seen early. Children will go so far in their attempts to make inanimate objects behave as they wish them to that they will break to pieces mechanical toys which they cannot control, will pound large blocks in an attempt to make them go into small holes, slam large objects against the sides of doors when the doors are too narrow to allow the objects to pass through, and so on.

Aggressive reaction to persons may take the form of bullying and bossiness, or it may take the form of a pretended weakness which will allow the child to achieve his end as well as if he had used a direct command. Pretended illness, headache, and nausea may be used as weapons which will bring the whole family to terms. This type of reaction might be termed either "aggressive" or "defensive" in regard to persons.

If the child finds that the temper tantrum will give him power over his environment, then that is the type of reaction which he uses. If he finds that showing off will for the time being control the people with whom he comes in contact, either by getting their attention in the form of

approval or by causing them to show excitement, then that form of reaction is used. The author has seen any number of instances in which control over an adult was secured for a brief period by the process of putting the adult in a position in which he had to justify himself. In one instance a little girl was accustomed to stop all punishment and all attempts to control by saying, "You don't love me. You never loved me as much as you do my brothers and sisters." The mother immediately began to explain to the child how much she did love her. Control over the mother was gained in this way.

Symptoms of disease are all too frequently used as a means of controlling, though they may also be used as a means of defense. If a child fails to gain his own way, he states that he has a headache or that he is nauseated or has neuritis or a pain in his arm or any other symptom which will make the parent do what he wishes to or will make the parent stop forcing him to adopt a pattern which he is resisting. A four-year-old boy yelled at the top of his voice, interrupting his parents' conversation at the table. Instead of saying, "It is our turn now. You may have your turn soon," his father said, "If you don't stop that noise at once you will have to go to bed without finishing your dinner and especially without dessert." The child continued to scream and was sent to bed in an adjoining room. His parents overheard the following, "Oh, please, God let me faint so daddy will worry about me and let me have dessert." The next morning the child protested that God did not answer prayer, a fortunate sequence of events, for had the child become ill because of his desire to dominate his parents a pattern of illness would have been started as both an aggressive and a defensive reaction.

There are countless adults in whom neuritis, fainting, unexplained pain, and nausea are still used to gain their end. Suffice it to say that no symptom should result in the child's conquering either his environment or the persons within it. Lack of success in the use of such reactions shortly inhibits them. Success makes them a permanent part of the individual's behavior.

Often children find that a temper tantrum will both get attention and result in making adults carry out the wishes of the child. This, then, is the form that the self-assertive tendency takes. If the control over the environment is best gained by a cooperative attitude and pleasantness on the part of the child, the tendency to self-assertion finds its outlet along these lines. Any of these forms of behavior listed above have as their end the assertion of the child's personality. It rests with the adult to make satisfactory such forms of self-assertion as will lead to better adjustment and to make unsatisfactory such forms as interfere with the welfare of the child and his adjustments to the members of his family and to society.

Where the tendency to aggression has been inhibited, the individual's reactions are often governed by those feelings and attitudes of inferiority which are termed the "inferiority complex." The child has not been allowed to get the pleasure which comes from taking command of situations, of people, and of things; he has not been allowed to overcome his own obstacles or to feel himself able to compete on equal terms with his fellows; he therefore develops the feeling that he is unable so to compete. The feeling of inability to meet his fellows on terms of equality inhibits his activities and makes him unable to adapt to situations in which he is required to take responsibility or

to get ends accomplished by means of his own initiative and force.

So important is this drive in the behavior of all individuals, whatever their age, that children should be conditioned early to the situations in which success adjusts them socially. In a word, they should never receive the center of the stage or domination over adults or other children through asocial self-assertive patterns. On the other hand they should receive the center of the stage for successes in which socially they must function aggressively. Praise for success of a social nature is only one means of conditioning them adequately.

The following points are of the utmost importance in the treatment of a child:

1. He should be allowed to overcome obstacles by himself, wherever possible. This means that he should be helped only where his own strength and the number of habits which he has developed are insufficient to cope adequately with the situation.

2. He should be given opportunity to compete with his fellows, and those things in which he excels should be stressed sufficiently to give him confidence in himself, but not so strongly stressed as to make him feel vastly superior to his group.

3. He should be allowed to react defensively against individuals and things which obstruct his normal activities. He must have outlets for activity, and, if his outlets are such as to appear harmful to himself or to others, it is the business of the educator to substitute desirable responses

for the undesirable ones, instead of merely attempting to repress these activities. The child who has not the normal defensive and aggressive reactions against things and persons is likely to be oversuggestible and timid and to take on too much the color of any environment in which he finds himself. He may, and probably will, let others do his thinking for him and make decisions to which he will conform, irrespective of the actual use of such decisions to himself.

Teachers and others who control children frequently make use of the instinctive tendency to self-assertion in competitive games and in rivalry in the schoolroom. There has been a great tendency on the part of educators to do away with this use of rivalry and to put in its place a variation of the tendency to compete. This variation takes the form of having the child compete against his own record, as, for example, the use of educational measurements monthly or semi-annually and the use of practice cards in arithmetic. In each instance the child knows the record which he made in the previous set of educational measurements or on previous practice cards, and he attempts to better it. The satisfaction which the child receives from competing against his own record appears to be as strong as the satisfaction which he receives when he competes against rival children. The same type of competition appears where students compete against records which have come in from other colleges. Here again the competition involves a record and not a person or group of persons. This type of use of the desire to compete does away with many of the ill effects which come as a direct result of competition against persons and is therefore greatly to be preferred.

Gregariousness. Gregariousness, or the tendency to be more satisfied when in company than when alone, appears in its earliest form in the baby who cries when left alone, though apparently comfortable in every other way. Crying, which is due to the fact that he feels the absence of adults, ceases when his mother or nurse comes into the room. Little children appear to be better satisfied if, during a part of their playtime at least, there is an adult close at hand or if there are other children playing near by. Children do not, however, in the first few years of their lives, show any tendency to engage satisfactorily in group play or in group projects. They appear to be much better content if left to work out their own simple plays, but they almost invariably work out such simple plays near other children of their own age, if such happen to be present. In nursery-school groups it will be observed that, when one or two children go to the sand box, the large majority of the children go there also, even though they play by themselves and with their own toys.

At five, group play reaches a peak. The circle of the kindergarten and the ring singing game are expressions of this drive to function in groups. At seven, and in some cases a year earlier, there appears to be a change in this pattern, and the single friend or "chum" becomes important at the expense of the group. This chum may or may not be kept for a long period. The children tell each other their secrets and are sometimes inseparable even when they function in a larger group.

At nine these friends include one or more other individuals in a club. The club always has a name, a symbol or badge, and three or more children, all officers. The purpose of the club appears to be to quarrel, since the members fre-

quently insult each other, the meeting breaks up, and the members go home promising never to return, only to be found playing together later. This behavior is repeated countless times. If the adults in charge of the children listen to the conversation, neighborhood quarrels may be provoked that are serious and lasting. The club members' statements reflect not only on each other but on their immediate and remote ancestors. If an explanation of this behavior may be hazarded, it is probably that the club members are attempting to find out how far each may go and still be accepted socially.

As the child grows older, this tendency to mix in with groups becomes stronger, until, between the ages of eleven and twelve years, it reaches its height in interest in gangs. Interest in gangs and later in groups continues to be more or less strong during the adolescent period and finds its outlet in the formation of fraternities and sororities in high schools and colleges and in the formation of more or less exclusive clubs and associations in adulthood. This tendency to be a part of a crowd lies at the basis of most of the enjoyment which comes from parades, games, and the like. A good game of any sort, witnessed by few people in the stands, is likely to be a flat and uninteresting performance, while even a poor game played to a large group arouses enormous enthusiasm and appears to give satisfaction to the spectators. A parade passing when few people are on the street, even though the parade be interesting, seems to arouse little enthusiasm. Sociologists tell us that the desire of peoples to come together at stated times in large groups appears to lie back of much of the pageantry and festivals of the older nations.

This drive involves desire not only for group contacts

but also for friendships. These latter may be all the way from playing together occasionally to what amounts to fixations. One of our cases, a boy of three and a half, was so absorbed in his friendship with a girl of the same age that he was unhappy to the point of illness on the days when she was not in nursery school. On one occasion when the girl was absent for a week he refused to attend on Friday and would only attend Monday when promised that she would be in the group. The girl, Edith, had many other friends, but the boy insisted on being a part of any group with which she played. When on two occasions he was excluded from the group he cried himself sick. Gangs of three and a half to four years old are frequent in all nursery schools. These gangs consist of three or more children. Sometimes as many as nine will belong to the same group. Beaver (2) offers instances of gangs of the same type, though his gang is not so large as many of those observed in our nursery group. These gangs continue through kindergarten. Between six and seven years of age our cases frequently show a desire to have a single friend or "chum." This in turn at the age of nine changes to interest in a club of three or more individuals, all officers of the group. Hardy (10) has described accurately the characteristics in older children which appear to make them popular or unpopular with their fellows. They are superior in behavior (classroom), higher in intelligence, in tests involving physical development, health, and very complicated skills. This list does not hold for children of nursery-school age. Popularity here may be due to skills not present in other children, (somewhat like Hardy's category), to a higher degree of imaginative play, to certain characteristics of leadership difficult to analyze. In no case have our gang leaders shown low intelligence, but they have frequently been

less intelligent than a number of the individuals in their gangs.

Where a child of school age appears to be solitary and unwilling to join his fellows in their games and be a part of the group, it should be taken as a sign of some defect in training or of some peculiarity in make-up. An analysis of the cause of a child's withdrawal from his group should be made at the earliest possible moment, inasmuch as this behavior, if allowed to go on, may develop distinct pathological trends. Children should be encouraged to get together in groups from early childhood, even when they are still too immature to engage in group projects. The cultivation of the group spirit and the use of the motive of social approval and disapproval, which comes out of the fact that young children are together in groups, is one of the contributions of the nursery-school movement.

Play. The instinctive tendency to play shows itself in the more or less random movements of the young infant and in his experimentation with all objects which come within his reach, including his own limbs and body. The infant's attempts to touch his foot may finally result in his putting the foot in his mouth. All those movements which result in an object's being tasted, touched, hammered, and moved about have as their outcome the development of the child's knowledge of the real world. Manipulations of the vocal cords in crying and babbling and later in approximating real sounds are examples of the play instinct, but they have as a direct result the acquisition of language. The random movements of the infant are again manifestations of the play instinct, but they have as their outcome the development of control over the whole group of skeletal muscles.

The first period of the child's life is purely experimental and manipulative. Every object with which he comes in contact must be made to yield every possible sensation. Objects are not really known until they are experimented with. The spoon, which the child merely sees, is an object, vaguely differentiated in size and shape, yielding a sensation of brightness. It becomes a spoon only when it is tasted, touched, felt, used as an implement to pick up food, and hammered to make a noise; in a word, when all of its possibilities of use to the child have been exhaustively experimented with. The puppy, merely seen as it moves across the floor, is again an object vaguely differentiated as to size and shape. It becomes fully known only after it has been lifted, its weight felt, its softness noted, the noise which it makes heard; after it has been pushed, pulled, hugged, made to roll over, made to walk and run; in short, after the child has gained from it every type of sensory and perceptual experience which his age permits him to gain. Not only is his knowledge of objects gained in the manner described above, but he gets clearly the activities which go on around him only when he has dramatized them for himself in his play life. Sweeping, cooking, dusting cleaning, and all the activities of the home are of vital interest to him during the first four years of his life, and we find him getting his chief amusement out of going through these activities, even if these are wholly unnecessary in the home in which he finds himself. The child who plays the milkman delivering milk, or the fireman putting out the fire, or the nurse taking care of the baby, gains a knowledge of the processes involved in these activities which does not come unless he has had actual experience with them.

The child passes gradually from a period of individualistic play, in which he delights in experimenting with objects, into a period of play in which he will work with two or more other children toward some end. Evidences of this working together in groups can be found at times in the nursery-school period, usually not earlier than the age of three years. Children of this age will work together to build an incline up which automobiles and streetcars may be drawn, or a road down which wagons, trucks, and other vehicles may be sent, and will engage in other simple group activities. The play may be fairly complicated; for example, at each side of the road, hills and rivers may be placed and even houses built, the houses being usually of a very simple form. One group of five children was observed to mark off a space with blocks, approximately 8 by 10 feet in size, and in this space to build a railway system including several stations, a bridge, and two inclines. The group worked together and played with the trains over a period which lasted a week. Three boys, between the ages of three and a half and four, worked to build an incline with which they played amicably for three days. Such evidences of group projects before the age of three and a half to four years are, however, relatively rare.

There appears to be a marked change, with maturity, in the direction of interest in play. Three-year-olds enjoy activity as an end in itself and are likely to get so interested in an activity that the end is lost sight of. A child who starts out to make a boat by hammering a long nail in the center of a block of wood may continue hammering in nails until the whole block is covered with them. A young child who starts out to draw a cat may become so interested

in some of the movements involved that he covers the page with scribbling. At four there appears to be somewhat more interest in the end, but the activity itself is more often the dominant interest. At five, though activity is still an interest, very good results in the making of objects may be obtained. Doll furniture, valentines, Christmas-tree decorations, and other pieces of work involving effort and a perception of the object to be produced constitute projects of great interest. Such types of work can hardly be accomplished by the three-year-old. They should not be a part of his educational program unless he is more advanced than other children of his age and has developed an interest in them.

According to Dr. Whitley (22), we may note already some differences between boys and girls of five or six years of age in their choice of playthings and in their play activities. She states that "more girls than boys choose painting and crayon coloring, and that girls are content with that occupation longer." When girls draw, they choose flowers, whereas boys choose ships and engines. The girls show greater interest than do boys in aesthetic expression and in the presence of color in their larger constructive work. They use more decorative effects outside and inside of houses and show more originality and more artistic ability in their collections of leaves, pebbles, ornaments, handwork, and sewing. Boys, on the other hand, enjoy carpentry, "and many, even at six, have glimpsed some of the mechanical problems involved in their construction work."

The writer has noticed no such marked difference except where training has brought about a difference in interest between girls and boys at this early age. In the groups that the writer has observed, there appeared to be marked

interest on the part of girls in carpentry, in tools, and in the construction of rough block houses and other large buildings. Three girls between the ages of nine and ten spent the greater portion of two weeks in the construction of a brush and log house in the woods and appeared to be as delighted with their constructive work as boys of similar age and interest would have been. The recent interest in summer camps, in which the girls are allowed to explore the woods in search of new birds and animals, to take long trips in which they make camp, build fires, cook food, and paddle their own canoes, is indicative of the fact that girls show the kind of interest in outdoor activities that was previously believed to be characteristic of boy development alone. Whatever the evidence for or against sex differences in play interests in the later years, it is fairly well agreed that such differences are not marked in the preschool period.

As early as at eight or nine years of age children get together to play the simpler forms of group games, but the activity is hardly a group game in its result. A group of nine or more small boys play baseball and frequently take up all the positions on the team until the important position is reached. The rest of the game is lost in the struggle to decide who is to be pitcher and catcher and who is to be at bat, and the group seems to receive as much pleasure from the argument over the relative positions as the older boys derive from playing the game. Group games of children of this period most frequently terminate in arguments, but the practice that is being given them in working together prepares for the real group game, which may be played successfully by children of eleven or twelve. Interest in group games increases steadily through the adolescent period, and this interest is used as a controlling force in high

schools, colleges, and universities. The boy or girl who cannot be made to live hygienically by any other means will yet go in training for games or for track meets, though the business of such games is to add glory more to the college than to the individual member of the team. Group games cannot be used with any success in the nursery-school period. No attempt should be made to introduce them even in their simplest forms.

The Tendency to Do as Others Do. The tendency to do as others do is frequently termed "imitation." There is a great mass of discussion as to whether imitation is an instinctive tendency, but the point at issue seems to be, not whether children tend to do as others do, but whether there is such an instinctive tendency to imitate as will enable the individual to perform an act hitherto unlearned. The point around which the discussion seems to rage is whether, when you perform an activity where a child can see it, he copies it. Thorndike (19) gives numerous illustrations of activities which babies do not copy and summarizes his discussion by a statement much on this order: All that we seem to have as instances of the instinctive tendency to imitation is a few babies who have stuck out their tongues when adults have first performed a like activity.

The solution for the difficulty may be found, however, in further statements of Thorndike. This author makes the point that the child cannot imitate any activities for which the path has not already been laid down. If the activities which the baby is required to imitate are such that he has not previously had experience with them, no amount of performance of such activities would give rise to imitation. Even if certain of the pathways have been laid down, the act which is imitated will be performed less readily and less

accurately if it has not been performed a number of times. Certain of its elements may even be omitted.

Whether one proves the point that there is an instinctive tendency to imitation or not, one must take account of the fact that children do as others do and that the more intense the stimulus, for example, or the more outstanding the personal characteristic, the more does it tend to be followed, provided the activities necessary have been acquired. The presence of a crying baby in a group of babies will nearly always lead to crying on the part of the whole group. The young child who comes into contact with the temper-tantrum adult, or the adult with any other peculiarity of behavior, is likely shortly to give evidence of the same type of behavior. One of the most interesting illustrations of the tendency to imitation in the very young child is found in the case of the baby, aged five months, who gave an occasional cough. Physical basis for the cough was sought by means of every kind of physical examination. It was finally discovered that the baby's father had as a mannerism a similar occasional cough. There was no physical basis for the cough, but the baby had apparently copied the activity from his parent.

Much of children's learning is stimulated by the models which they attempt to copy. This tendency to do as others do can be used to great effect in developing regularity of living, self-control, courtesy, and others of those qualities of character which make for a good adjustment in society. It can also be used to good effect, and is so used, in the acquisition of what is termed an "education."

The Tendency to Become Uncomfortable at the Sight of Suffering. This tendency has frequently been called "sympathy," but

the term involves much more of conscious adaptation and much more maturity of experience than is involved in the first manifestations of this tendency. The child becomes uncomfortable in the presence of what appears to be discomfort in the people who surround him. This tendency may be purely the tendency to take on the facial expressions of people with whom one is, and the facial expression or motor attitude so copied may give rise to an emotion. The writer finds no reason to believe that this so-called "instinctive" tendency cannot be partially explained in this way, but the behavior which it gives rise to is present in young children and does continue, unless inhibited by later experiences, throughout life.

The Tendency to Take Care of Weaker Things. This tendency appears to be present in the majority of young children. If one includes a two-year-old in a nursery group of three- and four-year-olds, one must guard carefully against too much attention and care from the rest of the group. Unless care is taken, three- and four-year-olds will all too frequently "spoil" the youngest child. A weaker, less developed child in a nursery group will also tend to receive too much care. Behavior of this type is classified under "mothering behavior," "motherliness," and similar headings by other writers. How much of it is acquired, and how much is due to an inherited drive, has not yet been determined.

Sex. The sex instinct appears universally, but unlike most of the other instinctive tendencies, the period during which it functions at greatest strength is delayed. Certain manifestations of the sex instinct appear at birth in connection with the emotion that Watson calls love; *i.e.*, the infant reacts positively to stroking and petting.

The sex instinct has a two-sided manifestation, a psychic and a physical. The child appears to pass through three distinct periods in regard to the manifestation of these phases. The first period is from infancy to between three and five years of age—a neutral period in which there appears to be very little interest in sex and in which the side of the sex instinct which is stimulated is largely psychic.

Toward the end of this period children begin to ask questions which can be interpreted as interest in sex but are probably more truly classified as a phase in the development of language. The "where" and "what" stage of language which immediately precedes the "why" stage is characterized by a large number of questions as to the place from which objects came, what they are for, and what they have been doing previous to the time at which the subject is experiencing them. Questions which take the form of "Where does the baby come from?" are natural inasmuch as children ask anyone who has just come into the room "Where have you been?" and anyone leaving "Where are you going?" Such questions probably do not mark the termination of one stage in sex interest and the beginning of another as much as they mark the beginning of the above types of questions. The age at which actual sex interest begins is probably determined by physical changes. In early infancy the functioning of the sex glands may be so slight as to make it impossible to determine his sex from the facial characteristics of the baby. As age increases masculinity and femininity become more and more marked. By kindergarten age it is relatively easy to determine the sex of the child where all the children are wearing a uniform pattern of dress, such as overalls. Sometimes this period is prolonged indefinitely. One of the writer's cases had to have his curls

shaved and to wear clothes which were obviously masculine in order to avoid confusion among his playmates and among visitors to the nursery school. On the other hand, one sees an occasional infant in which masculinity or femininity is so obvious that no disguise in the form of clothes covers the masculine or feminine characteristics.

Interest in sex as a field of knowledge appears to begin somewhere during kindergarten age. By the age of seven this interest has led to the child's receiving full information either from his family or from his less well-informed friends. This interest appears to be spasmodic during the period from five to nine and more or less continuous from ten through twelve to fourteen. Interest in sex is shown by repeated questioning. Usually the same questions appear at intervals of several months and must all be answered over again each time. Interest in sex reaches its height in the late preadolescent and the early adolescent period, until the point is reached at which the sex drive and the emotion love integrate to form the pattern which we call "falling in love." Up to the time of this integration there are on the psychic side evidences of strong affection; on the physical side there appear to be certain definite physiological and glandular changes which give rise to definite sensations. These occur in greater strength as one reaches the adolescent period. Between five and nine appears to be the greatest period of sex curiosity, and it is the period during which all possible information should be given in answer to the child's questions. It is during the period from between three and five to just before adolescence that bad sex habits are often set up. With the onset of adolescence the psychic and the physical sides of the sex instinct seem to become united and to become dual aspects of the functioning of the same tendency.

Out of the psychic side grows all the emotional life which we originally called manifestation of the parental instinct, as well as much of the rest of the emotional life at adolescence.

Certain cautions should be observed during the undifferentiated period—roughly from three to twelve years of age:

1. The child should have much outlet for activity, so that his attention may be directed away from body play.

2. He should not be allowed to sleep with other children or adults.

3. Absolute cleanliness should be insisted upon.

4. The clothing should be watched to see that it is not tight.

5. All types of exercise which produce sex excitement should be avoided.*

If masturbation has been developed through carelessness, all the above cautions should be observed, but the child should on no account be made conscious of the fact that the habit is a serious one. States of shame and self-disgust which are set up by adults in an attempt to stop bad habits are much more serious and far reaching in their effects than the effect of the habit itself. In correcting the habit, every attempt should be made to focus the attention away from the act and on other types of activity. The child should not be permitted to lie in bed long in the morning after he is awake, unless he has with him toys with which he may play.

* These cautions also apply to the period from infancy to three years. Body play of a sex type often starts during this period. It should be kept clearly in mind that such activity may, and often does, start merely as body play, on a level with playing with arms, fingers, toes, and the like.

The guidance of the sex life of the child through the adolescent period is a difficult problem, unless the proper instruction has been given long before that stage, and unless the child has received definite training in those qualities of character which underlie self-control. Sex instruction should begin as soon as children begin to ask questions. At each age such instruction should be adapted to the degree of maturity which the children have reached.

Other Activities and Tendencies Which Have Been Termed Instinctive. In the older enumerations of instinctive tendencies we find listed such instincts as acquisition and possession, collecting and hoarding, kindliness, teasing, bullying, cleanliness, self-display, rivalry, emulation, and hunting. The activities which grow out of all these so-called "instincts" probably can be subsumed under the categories already listed. Acquisition and possession appear to be part of the instinctive tendency to self-assertion. Those things are acquired which manifest the individual's position in the world and which give him an added sense of security or a sense of superiority over his fellows. Collecting and hoarding appear to have the same end result. The child collects those things which make him have a larger number of buttons or marbles or any other objects than the group in which he happens to be at the stated time. In young children one finds this so-called "collecting" tendency not operating. The child picks up things, plays with them for a short period, and then goes off and leaves them without any attempt to collect objects of the same sort, or in fact to store away objects of any kind. The only thing which might in any way be considered in the light of collecting is the child's attempt to snatch from any other child any object in which he is interested. Since no attempt is made to store

these objects away or to keep them beyond the period in which interest in them is intense, this could hardly be called collecting.

If the test of an instinctive tendency is its universality, then one finds that the tendency to collect and hoard could hardly be called instinctive. In primitive peoples it frequently does not appear, as, for example, in the savage who has only sufficient equipment to enable him to keep alive. He does not appear to collect and hoard, to acquire and possess, until the conditions of life are such as to give him the leisure to engage in such activities, in order to make himself a more outstanding member of his tribal group.

Tormenting, bullying, attracting attention to oneself, display, and adornment are certainly traceable to the instinctive tendency to self-assertion. The young child, and, in fact, a large proportion of older children and adults, will do much to make themselves the center of attention. Such concentration of the attention of others upon one's performance increases greatly the sense of one's importance, in a word, magnifies one. Certainly no great ingenuity is required to trace the relation between such behavior and the general drive to self-assertion. Display and adornment are means of attracting attention. Occasionally one finds the individual doing away with all possible adornment in order to attract attention by the very plainness of his attire.

Recently the viewpoint in regard to bullying has undergone a change. In many instances behavior of this sort is directly traceable to an attempt to compensate for a feeling of inferiority. A boy overlarge for his grade and doing poor

work may compensate for the inadequacy which he feels in the schoolroom by a domineering attitude and fighting on the playground. Similarly a child who is small physically may hector and tease a larger boy when he feels that his parent is near at hand to protect him, thus bullying when protected to compensate for a sense of physical inferiority when not so protected. Showing off, attracting attention by ornamentation, and the like may also be compensatory, though in the main one needs no further explanation for the appearance of such behavior than the satisfactory results which accompany it.

In discussing the instinctive tendencies it must be kept clearly in mind that these tendencies are general in nature and that the direction in which they function depends upon the stimuli which surround the infant and upon the results which his reactions to such stimuli produce.* If a tendency takes an outlet socially undesirable and the results are unpleasant, other and more successful outlets will be found. If a tendency takes an outlet the result of which is satisfactory, that particular reaction or set of reactions will tend to be perpetuated. Children are not at the mercy of a set of inherited reactions. On the contrary, the conditions in each child's environment are constantly selecting one type of behavior to be perpetuated and another to be eliminated.

A viewpoint such as this just expressed places the major part of the responsibility for the behavior of children, not on inherited tendencies or drives, but squarely on the parent and the educator. There are, however, great differences in the ease with which children are conditioned to make desirable responses. One child may present relatively

* See chapter on Habit Formation.

few problems, while the training of another may require all the ingenuity and resourcefulness which the best trained parent or educator possesses.

EXERCISE

Keep a diary record of your subject for a period of one hour on three days. (These may be successive or separated by not more than three days each.) The subsequent exercises are based on an analysis of this diary record.

List the number of types of activities which occur.

Classify the activities observed in regard to the instinctive tendencies to response which seem to be represented. For example, list the behavior of the child in regard to overcoming obstacles, show how many times the child attempted to become the center of attention, how often he tried to dominate other children.

What general drives are represented by the activities listed?

How far does the behavior appear to be unlearned? Learned?

Compare the behavior of your subject with a group of subjects of similar age. Draw conclusions as to

A. The universality of certain forms of behavior

B. The presence of learned elements

C. Any individual differences in the strength of instinctive tendencies.

Bibliography

1. Adler, Alfred: "Understanding Human Nature," Greenberg, Publisher, Inc., New York, 1927.
2. Beaver, A. P.: "A Preliminary Report on the Status of a Preschool Gang," *Child Development Monographs*, No. 1, Teachers College, Columbia University, New York, 1929.
3. Campbell, E. H.: "The Social-Sex Development of Children," *Genetic Psychology Monographs*, **21**: 461–552, 1939.
4. Curti, Margaret W.: "Child Psychology," Longmans, Green and Company, New York, 1940.
5. Dennis, Wayne: "Infant Development under Conditions of Restricted Practice and of Minimum Social Stimulation: A Preliminary Report," *Journal of Genetic Psychology*, **53**: 149–157, 1938.

6. Ezekiel, L. F.: "Changes in Egocentricity of Nursery School Children," *Child Development*, **2**: 74–75, 1931.

7. Freud, Sigmund: "Collected Works," Random House inc., New York, 1938.

8. Goodenough, Florence: "Developmental Psychology," D. Appleton-Century Company, Inc., New York, 1935.

9. Groves, Ernest R., and G. H. Groves: "Sex in Childhood," Macaulay Company, New York, 1933.

10. Hardy, M. C.: "Social Recognition at the Elementary School Age," *Journal of Social Psychology*, **8**: 365–384, 1937.

11. Isaacs, Susan: "Social Development in Young Children: A Study of Beginnings," Harcourt, Brace and Company, New York, 1933.

12. Jersild, A. T., and F. V. Markey: "Conflicts Between Preschool Children," *Child Development Monographs*, No. 21, Teachers College, Columbia University, New York, 1935.

13. Lewin, K., R. Lippitt, and R. White: "Patterns of Aggressive Behavior in Experimentally Created Social Climates," *Journal of Social Psychology*, **10**: 271–299, 1939.

14. MacDougall, William: "Psychologies of 1925," Chaps. XII, XIII, in Carl Murchison, editor, International University Series in Psychology, 1926.

15. McGraw, Myrtle B.: "Growth, A Study of Johnny and Jimmy," D. Appleton-Century Company, Inc., New York, 1935.

16. Maudry, M., and M. Nekula: "Social Relation between Children of the Same Age During the First Two Years of Life," *Journal of Genetic Psychology*, **54**: 193–215, 1939.

17. Sherman, Mandel: "The Differentiation of Emotional Responses in Infants, II," *Journal of Comparative Psychology*, **7**: 335–351, 1927.

18. Sherman, Mandel, I. C. Sherman, and C. D. Flory: "Infant Behavior," *Comparative Psychology Monographs*, **12**, (59), 1–107, 1936.

19. Thorndike, E. L.: "Educational Psychology," Vol. I, Lemcke & Buechner, New York, 1903.

20. Watson, J. B.: "Behaviorism," Lectures V and VI, W. W. Norton & Company Inc., New York, 1930.

21. Watson, J. B.: "Psychology from the Standpoint of a Behaviorist," Chap. VII, J. B. Lippincott Company, Philadelphia, 1919.

22. Whitley, Mary: "The Child, His Nature and His Needs," The Children's Foundation, Valparaiso, Ind., 1928.

INNATE RESPONSES AND TENDENCIES TO RESPONSE

C. THE EMOTIONS

THE ACTIVITIES AND SETS INVOLVED IN THE PRIMARY emotions must also be included in any catalogue of activities and tendencies to activity inherited by the human infant. These emotions involve two sets of adjustments—changes in the visceral and glandular processes, and changes in the skeletal musculature. The awareness of these changes and of the stimulus which brought them about constitute the total state to which we give the name "emotion."

Bodily Changes Which Occur in Emotion. The physiological changes which occur in emotional states appear to be under the control of the autonomic nervous system (see page 160). There are three divisions of this system: the cranial, the thoracicolumbar, and the sacral.

The cranial and sacral divisions are operative in mild emotional states, such as mild joy, pleasant bodily states, mild happiness, and the like. All the emotional states which surround the operation of the sex instinct are under the control of the sacral division. The sacral and cranial

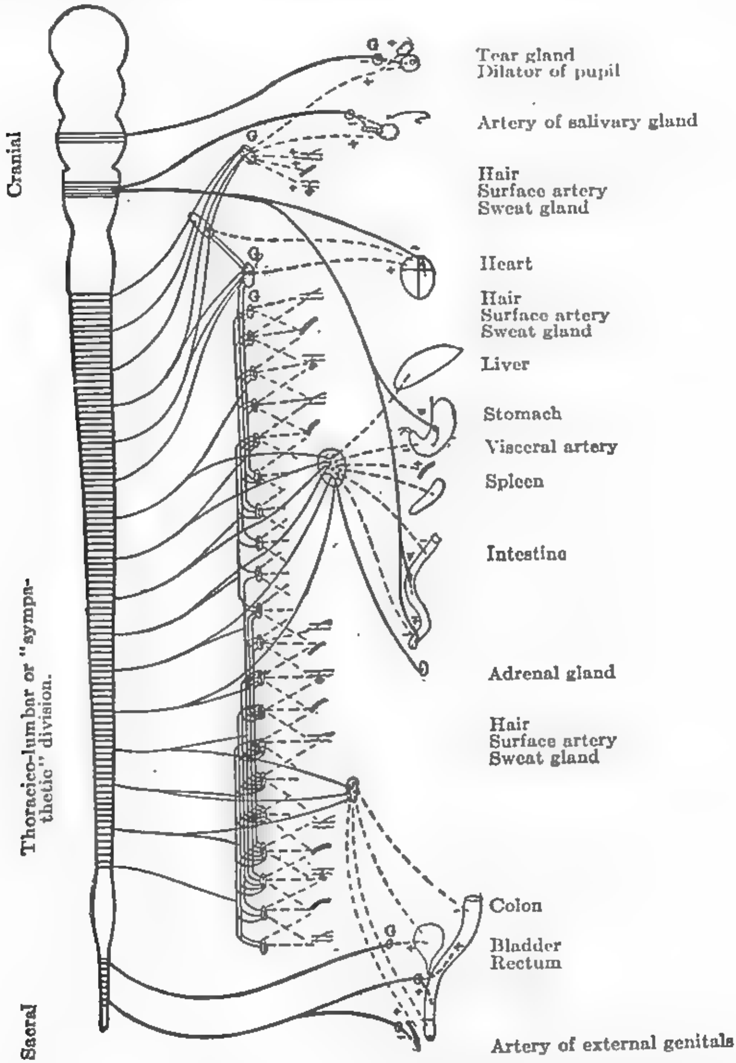


FIG. 10.—Diagram of the more important distributions of the autonomic nervous system. The brain and spinal cord are represented at the left. The nerves to skeletal muscles are not represented. The preganglionic fibers of the autonomic system are in solid lines, the postganglionic in dash lines. The nerves of the cranial and sacral divisions are distinguished from

systems may operate independently. Each of these divisions may be active in part without involving all the organs controlled by them. When the cranial and sacral divisions are operative, the activities controlled by the sympathetic division are inhibited. Similarly, when the sympathetic division is operative, the activities controlled by the cranial and sacral divisions are inhibited. For example, the cranial division operates the contraction of the pupil and the sympathetic the dilation. Impulses coming from the cranial division slow the heart; those from the sympathetic accelerate it, and so on.

The sympathetic division always acts as a whole. All the organic changes which occur in strong emotions are under the control of the sympathetic division. In fear and anger states the bodily changes appear to be as follows: Impulses proceed to the adrenal gland, causing a discharge of adrenalin into the blood. This substance acts on the muscles to increase their excitability to nerve impulses. It acts on the liver to produce a discharge of glycogen or blood sugar into the blood. The glycogen is carried by the blood stream to the skeletal muscles and provides additional food for them. The additional food and the heightening of excitability ensure greater rapidity of movement, greater muscular strength, and lessened fatigability. A substance is produced in the blood which makes it clot more readily. At the same time that these changes are going on, there is an increase in the rate of the heart and in the number of respirations per minute, and the blood pressure is increased. The adrenalin acts on the lungs to

---

those of the thoracicolumbar or "sympathetic" division by broader lines. A + mark indicates an augmenting effect on the activity of the organ; a − mark, a depressive or inhibitory effect. (*From Cannon, "Bodily Changes in Pain, Hunger, Fear and Rage," D. Appleton-Century Company, Inc.*)

cause greater expansion of the arterioles. These changes ensure the rapid oxidation of the blood. The visceral arteries in the abdomen contract and force the blood to the skeletal muscles. Changes also occur in the digestive tract. There is a cessation of secretion in the salivary glands and in the glands of the stomach and in the intestines. The churning movements of the stomach and the peristaltic movements in the intestines also stop.

If one places a cat which has been given a dose of bismuth in a holder and watches the operation of the digestive tract by means of Roentgen rays, one will observe the rhythmical movements of the digestive tract. If a dog is brought into the room, there is an immediate cessation of these movements. If the nose of the cat is held, these movements also cease. This phenomenon has been observed by Cannon (2) in rabbits, dogs, and guinea pigs; and in dogs by Le Conte, and by Bickel and Sasaki.

As an instance of similar cessation of movements in the digestive tract in human beings, in this case due to psychic disturbances, Cannon cites the case of a woman who came to him for digestive difficulties. Though she had eaten a test meal an hour before, an examination of the stomach contents showed no free acid and no digestion of the test meal. There was also present food from the supper of the previous night. This condition proved to be due to a night spent in intense emotional excitement.

A feeling of heaviness in the stomach, which is a more or less usual condition after emotional stress, may be explained in terms of the cessation of movement throughout the digestive tract. The dryness in the mouth present in fear states can be noticed by any public speaker in the

initial part of his speaking. To avoid this dryness many speakers employ cough drops or make frequent use of the glass of water which appears to be the essential accompaniment of public speaking.

The importance of the changes produced in strong emotional states was undeniably great under the conditions presented by life in primitive times. The purpose of these changes appears to be to produce a greater degree of energy with which to run away in fear states or to attack in anger states. The main differences which can be observed between these two states—anger and fear—are in the bodily attitudes which accompany them. In fear the whole tendency is to run away, to hide, to escape;* in anger the tendency is to approach and attack. The bodily changes would be equally helpful in either type of activity.

It is clear from an examination of the bodily changes which occur under the stress of strong emotion that there is very little reason for bringing them into play in their pronounced forms under civilized conditions. It is equally clear that children in either anger or fear states are physiologically in a condition which is far from stable.

The milder emotions, particularly those which grow out of the primary emotion of love, are frequently pleasant in their effects and result in correspondingly beneficial bodily changes. Joy, mirth, wonder, affection, gratitude, admiration, mild elation, and certain of the other emotional states appear to produce heightened tensity of the muscles, increased gastric secretion, normal peristaltic movements, and a general sense of ease and relaxation which we tend

* Occasionally a pronounced fear state produces paralysis or fainting. This type of behavior, except in the case of the death feint in animals, is disadvantageous.

to classify as a general feeling tone of pleasantness. It must be understood that these emotional reactions are a blend of physiological changes with ideational elements and that they bear little resemblance to the primary emotional states from which they are derived. They are the result of conditioning and appear to vary somewhat in their pattern, particularly in the pattern of the facial muscles. These emotions appear to be more under the control of the sacral and cranial divisions than of the sympathetic.

THE PRIMARY EMOTIONS

The emotions present at birth are fear, rage, and love, love being used to cover the variations in that emotion classified by Freud under the heading of sex.

Fear. According to Watson, the stimuli which arouse fear appear to be only two in number, (*a*) removal of support and (*b*) loud sounds. Fears of all other objects or situations are the result of later experience, in a word, the result of direct or indirect conditioning. The author disagrees with this point of view. The manifestations of fear listed by Watson (21, 22) are probably those ordinarily called "the Moro reflex" and associated with startling the child with stimuli of varying degrees of intensity.

It is highly probable that on the basis of a single general stimulus to fear, *viz.*, anything that produces insecurity, present at birth, all other fears are developed. The point of view taken here is that just as there appears to be a single general stimulus to anger, *viz.*, any blocking of motion or interference with purpose, so fear has an equally general stimulus, anything for which the child has not already

developed adequate responses or for which he cannot call on adults to make the needed response.

Valentine (19) points out that his cases were afraid when in a room alone but were not afraid of the same stimulus when in the room with their mothers. He states that a child in his mother's arms may not be conditioned to fear an object which when presented to a child alone in a room will produce fear.

The work of Valentine (19), English (3), Jersild (9), and Goodenough (7) indicates clearly that fears are conditioned on the basis of general insecurity derived from the fact that the children studied in each case had not set patterns to enable them to develop adequate responses to the situation setting up fear.

Since the physiological reflexes underlying fear behave as do other reflexes, these may be attached to any situation provided that the conditions are such that the child cannot meet them adequately. Objects and situations which produced no fear in infancy, when the child did not realize that the situations existed or did not see the objects, may later produce fear because the child sees them clearly and realizes that he is inadequate to deal with them.

Jones (10) found that children who had not been afraid of objects when three showed fear of these objects when five. This situation could easily be explained in terms of the theory presented here.

All authors have agreed that it is easier to set up fears in the first five years of life than after the fifth year. There is no time in the life of the child after the fifth birthday when so many situations are met for which he has not developed adequate responses.

Watson (21, 22) claims that there are only two specific fears. We contend that there are no specific fears. We agree therefore with Watson that fears are not inherited.

We are constantly being assured that children fear cats or the dark or other innocuous objects because such fears are inherited. The following series of tests on children not emotionally conditioned is cited to prove, in line with Watson's own statement of his results, "that illustrations of hereditary responses to furry objects and animals are anecdotal in their nature and not based on scientific experimentation." Some of the children studied were observed from birth through the first year, others through the second year, and several through the third year. A lively black cat was shown to the children. The cat was "affectionately aggressive," climbed over and walked around the infants many times. During the course of the experiment it rubbed its body against the infants. The children reacted positively to the cat. They reached out to touch the cat's fur, his eyes, and his nose. The second animal used in this series of experiments was a rabbit. This again called out manipulatory responses and no avoiding behavior whatsoever. A white rat was also used, and Airedale dogs both large and small. These last animals called out a certain amount of manipulatory response, but not so much as had the cat and the rabbit.

The work of Valentine (19) indicates that the conception of conditioning is correct as applied to fear states but also indicates that conditioning is not only the result of the stimulus applied. It is also dependent upon the environment of the subject, his general physical condition, and other factors. A child in his mother's arms may not be conditioned to fear an object which when presented to a

child alone in a room will produce fear. English (3) also found that subjects could develop fear states as a result of conditioning as did also Jersild (9) and Goodenough (7). The latter authors do not describe conditioning in the same terms as do Pavlov and Watson (21), but the descriptions of the behavior of their cases leave little doubt as to the part played by conditioning in the development of fears. The work of M. C. Jones (11) following the plan outlined by Watson not only supports the concept of conditioning but gives clear evidence as to the causes for the attachment and detachment of fears.

In the cases with which the writer has had contact, fears have been developed in four ways: (*a*) by direct conditioning; (*b*) by transference from one situation to another to which the child reacted as similar; (*c*) by verbal association of four types—(1) fear as a means of control, threats, and so on; (2) descriptions of events or explanation of events in frightening terms; (3) careless comments about food, drink, and so on; (4) stories involving frightening elements—(*d*) by imitation. It must be remembered that fear involves a series of integrated physiological reflexes in the previously described pattern. Just as the blinking reflex, which first appears in connection with actual contact with the cornea, is later attached to any object approaching the eye without direct contact by a process of conditioning, so the entire pattern of reflexes which give rise to the bodily sensations accompanying fear can be attached to any specific situation by the means listed above. The means by which the general sense of insecurity producing the physiological reflexes which are associated with fear is attached to other objects, situations, and persons are shown in the following cases.

Dr. Lillien Martin tells of a small baby who showed fear of being placed in his crib. The fear could be traced to the father's play with the child, in which the baby was thrown into the air and caught. The loss of support which occurred immediately upon the parent's removing his hands from the child as he placed him in the crib caused the same fear to arise as arose when the child was being tossed in the air.*

Transfer from one situation to another and completely dissimilar one often accounts for otherwise unexplainable fears. One of the writer's cases, whose paper napkin had caught on fire as the boy blew out the candles on his birthday cake, thereafter cried with fear whenever birthdays were mentioned. When urged to go to a birthday party he claimed earache and other physical symptoms as an excuse for not attending. Fear of fire in a paper napkin transferred to birthdays in general.

The ease with which fears may be attached to stimuli to which they were not originally attached, and the extent to which such fears may be transferred, may be seen from experiments conducted by Watson (21) and from experiments conducted by Mary Cover Jones. In Watson's experiments, Albert, a baby eleven months and three days old, was under observation. The baby had played with a white rat for weeks. In the beginning of the experiment, upon presentation of the rat, Albert began to reach for it, but just as his hand touched the animal, a metal bar, 3 feet long, was struck with a carpenter's hammer. This baby's reaction to loud sounds had previously been demonstrated to be characteristic of the type of fear reaction

* MARTIN, LILLIEN, and CLARE DE GRUCHY, "Mental Training for the Pre-school Child," p. 29, Harr Wagner Publishing Co., San Francisco, 1923.

which occurs in most children. When the bar was struck, the infant jumped violently and fell forward, burying his face in the mattress. The procedure was repeated with the same result. The child's condition was so disturbed that no further tests were made for seven days. The rat was again presented when the baby was eleven months and ten days old. The baby fixated the animal but made no attempt to reach for it. When the rat was placed nearer, tentative reaching movements began, but when the rat's nose touched the infant's left hand, the hand was immediately withdrawn. He was given his blocks directly afterwards in an attempt to see whether they had shared in the process of conditioning this fear. He began to play with them immediately. The experiment was continued, the rat being presented and the bar struck simultaneously. At the end of the series, the presentation of the rat alone caused the baby to cry and fall over. When eleven months and fifteen days old, the baby was tested with his blocks. These showed no effects of setting up the fear reaction. The rat alone produced an immediate whimpering response and a turning away of the head and trunk. When the rat was again presented, the baby leaned as far away from it as he could, fell over, and then, getting up on his hands and knees, he scurried away as rapidly as he could. The experimenter next presented in order a rabbit, a dog, a sealskin coat, cotton wool, and a false face. To the rabbit the baby showed a marked negative response. The dog produced some reaction, but not so violent a one as the rabbit had produced. When the dog approached closer to the infant's head, however, Albert straightened up, then fell over to the opposite side and began to cry. The fur coat produced a withdrawing reaction and crying. Cotton wool presented in a paper package produced a

withdrawing reaction to the wool, but the baby played with the paper, avoiding contact with the wool itself. Albert responded negatively to a Santa Claus mask with which he had played continually before the experiment. These experiments* give clear proof of the transference of fear states to situations with which they were not originally connected. They also serve to give at least one illustration of how fears of fur and the like may be set up.

Cleveland, in her book "Training the Toddler," gives the story of a little girl who suddenly developed a fear of a certain place on the stairs. Her fear of two railings was so great that a cloth had to be hung over the banisters to cover these two railings. The fear apparently had its origin in the following experience, the description of which is quoted almost in its entirety from Cleveland's book:

> The most notable event in Irene's family life had been the recent arrival of a baby sister. Irene, however, her mother said, had showed no strong feeling of any kind about the baby, had indeed almost never talked about her. This in itself was surprising enough to be suspicious, particularly in conjunction with the fact that she had talked at school about the baby's arrival, and had repeated several times in a puzzled strained way: "When she went to the hospital, she didn't have the baby, and when she came back from the hospital she did have the baby." She had not been prepared in any way for the baby's coming, nor had she asked any questions as to where it came from. . . . Further questioning revealed that she had several times been taken to see her mother at the hospital; that she had always gone up in the elevator but had usually walked down the one flight, as there was a small stairway near her mother's room; that this stairway was almost exactly like the one at the school. At this point it seemed fairly clear that she had experienced some shock; that whatever had occurred or had been said was beyond her comprehension, but that she had brooded on it in secret so that when she

* In citing these experiments, the author has largely paraphrased Watson's statements ("Behaviorism," Chap. Eight).

found herself in a similar situation to that in which it arose, the repressed trouble appeared as a phobia.*

The fear disappeared when, at the advice of the psychologist who saw the case, the mother talked to the child and gave her an opportunity to ask questions about the baby and get some outlet for her repressed emotions.

(*a*) Verbal conditioning may occur in connection with attempts to control the child, as "If you don't go to sleep at once a big, black man will grab you." (*b*) Stories, descriptions of wrecks at sea, children drowning, lightning striking people and "blowing them to pieces," bombing raids are all examples of verbal conditioning when the situation itself is not present. (*c*) Careless conversation before the child is also responsible for a number of fears. At the time at which a nine-year-old child was discharged from the hospital after being treated for a broken ankle, now completely healed, the nurses said to each other, "I can't believe that that won't cause more trouble. That was too quick a recovery not to be followed by difficulty." The child had been home only a week when she began to feel pain in the region of the ankle, and only an X ray and the doctor's verdict, given very firmly, that nothing was wrong convinced the child that there was no reason for pain. The pain itself disappeared at once and never returned.

Children's stories are often responsible for setting up fears. The "brave fireman who rescues children from burning" may be forgotten, while the detailed description of a house burning down may be remembered for years. Children's picture books with vivid portrayal of fearsome incidents may have the same effect as do stories.

* Cleveland, Elizabeth, "Training the Toddler," pp. 98–100, J. B. Lippincott Company, Philadelphia, 1925.

Many fears are started by imitation. The child sees some adult or some other child in whom he has confidence show a sense of insecurity in the presence of an object or a situation and himself begins to show similar signs of insecurity, always accompanied by the previously listed set of physical changes. Like other conditioned reflexes of a more or less complicated pattern these may be attached to any situation and the child may become afraid of milk, ice cream, candy, the movies, toys, and other stimuli ordinarily reacted to in a highly positive manner.

An illustration may serve to clear this point. The doorbell rang and the mother of a three-year-old child looked out a window and saw on the doorstep the umbrella mender. She leaned out of the window and said, "I heard you were dead. Is this your ghost?" probably in an attempt to be humorous. The child heard her and began to scream, for which he was spanked soundly. Thereafter the sight of the umbrella man caused screams.

The father of a four-year-old at the table described the macaroni, with pretended horror, "as white worms in milk." Macaroni thereafter produced crying and regurgitation when served to the child. (This is an illustration not only of imitation but also verbal conditioning.)

Fears may range all the way from fear of a single object to a fear attitude which is present in a number of situations. The first type may involve simple withdrawal from one object or a set of objects, accompanied by a mild emotional state. The fear state may be so profound as to produce temporary paralysis or even to produce a faint. Fortunately, such profound fear states are seldom met with. Fears may result in inhibitions of bodily activities, as in the case of the

child who will not climb or engage in rough play, and they may result in timidity and in unwillingness to face and overcome obstacles. They may result in a general feeling of inferiority for which the child compensates by bragging or boasting, by teasing and tormenting younger children, by a tendency to show off, or by any other sort of behavior which gives him the attention and the feeling of equality in the group of which he is a member. Children should be taught caution in regard to harmful objects and situations, but the effect of fear states is so profound and so far reaching that it is doubtful if fear should ever be induced or encouraged to persist if it has been set up accidentally.

All the varieties of behavior listed above as produced by fear states can be found in their earlier manifestations in the nursery-school group. All of them can be adjusted in a large measure by the use of the right methods of conditioning. Such methods involve, of course, cooperation between the home and the director of the nursery school, if the child is in such an institution, and they also often require the assistance of the psychologist, the physician, and the psychiatrist.

Such work as that of Harold E. Jones (10), Mary C. Jones (11, 12), and Florence Goodenough (7) has thrown still further light on the development of fears. The following is an adaptation of Dr. Jones's work on method of conditioning fears.

Methods of Reconditioning Fears. Fears may be reconditioned by various methods, but the degree of success with which this reconditioning meets depends largely upon the methods used. The experiments of Dr. Watson,

at Johns Hopkins University, and of Dr. Mary Cover Jones, at Columbia University, take up in detail the methods for reconditioning fears. In discussing these experiments, we shall use the terminology used by Dr. Watson and Dr. Jones (12, 21, 22).

*The Method of Disuse.** In one case the feared object was a rabbit. It was kept away from the child for a period of two weeks. When it was again presented, the fear was in no way diminished.

The Method of Negative Adaptation.† By this method is meant merely that the object is placed in a room with the child and he is allowed to get used to it. This method met with little success. The child appeared worried and at times cried in the presence of the feared object. The fear did not seem to diminish.

The Method of Verbal Appeal. Again the feared object was a rabbit. The child was told stories about the rabbit, she drew pictures of it, and she looked at the pictures of rabbits. She became so familiar with the verbal idea of the rabbit that she said that she had touched the rabbit one time when she had played with it. When the real object was brought in to the child, however, she again showed fear. The method of verbal appeal did not appear to be a successful one.

The Method of Distraction. In this method, the feared object was brought before the child, and the child was urged to observe objects of interest about it, as, *e.g.*, in the case in which the feared object was a rabbit, the length

* See first page of chapter on Habit Formation.

† For all the methods as listed, except the first, we have used the terminology of Dr. Jones.

of the rabbit's ears and the color of the rabbit's eyes. This method was not successful. Dr. Jones gives no special explanation as to why this method met with no success, but the writer is of the opinion that what actually happened was that the child with a fear state paid no attention to the objects which were pointed out because the fear state occupied all his attention.

The Method of Repression. In this case the child was led to repress the fear by ridicule or by other means. The result of this method is not only not to diminish the fear itself, but there may be set up, in addition to the fear of the object, certain attitudes which influence the child's behavior more adversely than the fear itself.

Two methods appear to be successful, the method of social imitation and the method of direct reconditioning. In the first instance, the child is led to play with the feared object, because other children of his own age show interest in it and no fear of it. In the second instance, pleasant experiences are associated with the feared object.

The Method of Social Imitation. This method is often not effective unless the group of children who play with the child whom one wishes to recondition are of an age approximately the same as his. In many cases, having older brothers and sisters play with the feared object does not seem to be sufficient to show the child that the object is harmless. It must also be remembered by those who attempt to use this method that under some conditions the child who fears the object or situation may communicate this fear to the other children instead of himself being cured of it.

Many fears, the disappearance of which cannot be

explained, probably are eliminated on the basis of social imitation. For example, a child who has feared dogs may note that the neighbors' children play with their puppy unharmed. He may be encouraged to play with the animal and, when he finds himself safe with it, may lose the fear of dogs. It is, of course, not wise to take the position that chance may provide such conditions as these and that one can trust to chance that fears will be eliminated by this type of condition as children grow older.

The Method of Direct Reconditioning. In the experiments of Dr. Jones, the child was fed when the feared animal was in the room. The animal was brought closer to the child each day, and at the end of the period during which the child had been fed in the presence of the feared object, the fear appeared to diminish and finally to die away. As the experimenter herself says, great care must be used in employing the direct method of reconditioning, as the fear may transfer to the food and feeding situation instead of the food making pleasant associations with the feared object.* The method of direct reconditioning has widespread applications; for example, the child with water fear may be led to play in water by the use of water toys; the child with fears of the dark may be led to interest in the dark by simple games in which the child himself puts lights on and off and by direct association with other pleasant experiences with the dark. The extent to which this method may be employed is limited only by the resourcefulness and ingenuity of the adult who has the child in charge.

Changes with Increasing Maturity. Jones (10) has pointed out that there is a difference in the types of fear

* The food situation should never be used to recondition fear states except by a specialist in this field.

reaction with increasing age. Children originally not afraid of an object may at the age of three or three and a half develop caution in regard to an object, and at four develop fear where they have shown no fear reaction of this sort to the same object earlier. This does not mean that there are innate ideas in regard to these objects which do not mature until later, but rather, according to Jones, that older children are able to perceive that things are new and unusual. It is the perception of this quality of newness and unusualness to which the child reacts with fear.

The following statement quoted directly from Jones's article gives this point of view: "Fear arises when we know enough to recognize the potential danger in a stimulus, but have not advanced to the point of a complete comprehension and control of the changing situation."

It is probable that the number of objects which the individual fears increases with increasing age to six years, and perhaps beyond, in spite of the fact that emotional control is developing rapidly. Training in meeting situations which produce emotional states all the way from mild feelings of insecurity through worry and anxiety to fear is an essential part of the education of young children. What actually occurs in development is not only an increase in the number of situations to which a child responds with anxiety or any of the other manifestations of fear but is also a changing over from fear of objects to fear of ideas.

Fear States and Escape Mechanisms. As civilization has increased in complexity, man has tended to substitute for fear of actual concrete objects present to sense, fear of ideas. With the growth of this mechanism has developed withdrawal or flight in ideational rather than in physical

terms. Originally, fear of a lion actually present was followed by actual physical flight or, if cornered, by fighting. Civilized man develops a sense of insecurity in the presence of a situation which he cannot conquer when the situation is not present but is, on the contrary, to use popular phraseology, solely in his own mind. His flight takes the form of withdrawal from the idea or of submerging or sinking the idea below that conscious level at which he needs further to face it. He is still afraid of objects and he may still run from these, but most of his fear states take the form of all degrees of insecurity accompanying ideational processes and his flights take the form of withdrawal or flights from ideas in ideational form. These forms of flight or withdrawal are termed the "escape mechanisms." As the young child develops from infancy through the preschool period, his reactions to fear change in exactly this way.

The young child is afraid of actual objects. As he matures, ideas begin to produce the same degree of insecurity and the same bodily changes as were originally produced by actual concrete stimuli. At the same time, the reactions of the child change. Instead of physical withdrawal or flight from a stimulus or situation, the child develops those methods of withdrawing in purely ideational terms which are termed escape mechanisms.

Relegating to the Subconscious. The simplest method of escape is merely to bury the entire circumstance and to follow this by stating that it did not occur or that it occurred in some way which is acceptable. Here the escape is to push the real situation below the possibility of recall except under hypnotic conditions, drugs, shock, or delirium. In this level of forgetfulness there are many experiences

which are there solely because they are unimportant to the individual the material which one studied for a dull quiz, names and addresses of people no longer in one's environment, countless unimportant daily experiences, the experiences of the first year of life, and so on. To these are now added experiences which the individual does not wish to believe occurred.

He idealizes his mother and he sees her in a temper tantrum worse than that which might be experienced by an uncontrolled infant. He buries the whole experience and says "I dreamed it" or "It did not happen—she was just playing a game." The advent of a new baby may produce this behavior and the actual existence of the child be denied for some time. When a two-and-a-half-year-old was asked how a baby that had just come from the hospital was doing and what its name was, he said, "There is no baby in my house, no baby, just Mommy." Until the child accepted the fact of a second child in his home, he continued to deny the existence of the baby.

The same behavior is found in adults who, when they have been insulted by good friends, say, "But she didn't mean that, what she really said was . . . " and then give a sentence which is entirely acceptable or even complimentary. An excellent illustration of this in an older person on the verge of mental disease occurred when her child, who actually hated her, said, "I hate you always." The mother turned to the observer, saying, "She loves me so much that she will not show it to anyone unless we are alone."

Since in this mechanism there is no other carrier for the emotion substituted for the one which originally aroused it, the whole situation is buried together with its emotional

content. In later life this content may appear with no specific object. The individual is in terror, but he does not know of what. He has an anxiety neurosis but cannot be specific about the causes. While simple in its operation, this mechanism is apt to leave a trail of behavior highly dangerous. At best it leaves the individual feeling inadequate. At worst, anxiety neuroses, hysterias, undefined fears may be its concomitant.

Daydreams. A second method of escape from fear, worry, and anxiety is through daydreaming. The daydreaming may take various forms. In one type, a child images himself meeting the situation which produced insecurity and coming out victor.

A four-year-old who had the opportunity of hearing about parties which four of his friends had had was found seated quietly and apparently doing very little. When asked what he was playing, he said, "I had a better party than John. I had pink ice cream all over the table and one hundred candles." The parties among his friends had evidently produced an insecurity in him for which he compensated by imagining the party with a bigger cake and more ice cream.

Still another child who had been punched several times by a larger boy later said, "When I get bigger, I'm going to bite Jim and scratch him and kick him and sit on him." The situation which produced this insecurity could not be met by fighting and he therefore met it by means of fantasy.

Adults make use of this same form of behavior. An adult who has been insulted by a friend and therefore made

to feel insecure will often go home and think of all the witty and biting things that he might have said to his friend if he had thought of them rapidly enough. In acting through this situation with himself as a hero, the irritation is absorbed. He has met and conquered in his daydreams the situation from which he has escaped in reality. Gates calls this mechanism "conquering hero" behavior. This type of behavior is also used as a method of overcoming obstacles, as are all the following to be discussed in connection with escape mechanisms. They will be further discussed in connection with anger.

A second type of daydreaming which provides escape is what Gates refers to as the "martyr complex." Here the subject pictures himself as being unable to meet disturbing situations because more is expected of him than of other children. In this instance he meets the situation and comes out with a restored feeling of security by enjoying suffering. He pictures himself as sick, as a poor little boy who is made to work, and may even imagine himself being punished when no punishment has been administered. From this group are developed the individuals who "enjoy poor health." So much satisfaction may be had from withdrawal or flight from the actual situation through the enjoyment of imaginary suffering that few attempts to meet life situations are engaged in.

Daydreams in themselves are not wrong. On the contrary, much productive work is done in this way. The individual may plan out a trip, get the outlines for a story or a novel, hit upon a new way to attack the next day's problems, or even plan his lifework first in daydreams. It is the use of dreams to escape facing reality which is unwise, since the tendency to make use of this mechanism

may increase until it is far easier to daydream of accomplishment than to face reality day by day.

Projection may be of three types, only one of which occurs frequently in the first three years of life, although all occur occasionally. In the first type, the child feels insecure because of lack of success or because he has done damage to some article valued by him or someone else. Instead of facing failure and trying to determine what brought it about, which is the type of reaction for which the child should be trained, he blames something or somebody for his own lack of ingenuity or lack of forethought, or even for a lack of the capacity which in this situation would make success possible.

A three-year-old had built a tower four times with a small block at the base and larger blocks at the top. Each time the tower fell over. After four unsuccessful attempts, the child said, "The wind blew it." This same child later in the day fell over a chair and bumped his head on the floor, whereupon both he and his mother spanked the floor soundly for being so bad as to "hurt the baby." In each of these instances a brief statement to the child of the actual cause of the difficulty would have been a fairer way of meeting the situation.

In the second type of projection the child has committed some act which is socially undesirable and for which he knows that he would be blamed or punished if the act or thought were known. No one actually does know what the child has done, but be believes fully that he is being criticized by others because of his undesirable thoughts and activities. He withdraws from his own knowledge of his guilt and attaches the strong emotional content which

surrounds the guilt mechanism to individuals whom he blames for their unjustified criticism of him. No longer does he face himself as a person who is guilty. On the contrary, all thought of his own guilt is buried, but this does not release him from the emotion which his guilt originally aroused. The emotional content may be stronger than it originally was, but it is now attached to some person or persons other than himself.

Case A, aged eight, complained to her parents and relatives that her teachers believed her to be a thief. She sought punishment of the teachers, since it was outrageous for them to believe an innocent child guilty of theft. When the mother made discreet inquiries, the teachers revealed no idea that the child had been guilty of the innumerable small pilferings about which the other children were upset. Fortunately, the mother realized that this was the mechanism of blame or guilt and was able to develop in the child resistance to thieving while at the same time she released the strong emotion formerly directed against the teachers.

Projection of this type is extremely serious even when it is met in the relatively amusing form of the child who says, "No, he hasn't hit me yet, but I know he is thinking about it" when it is actually he who is thinking about doing the hitting. At adolescence this type of projection may go so far as to enable the individual to hear nonexistent voices criticizing him or to misinterpret scraps of casual conversation and believe them to be severe criticisms of himself. Paranoid trends are merely an exaggeration of this type of projection. Wherever it is found in young children, or, indeed, at any age, children should be made to face the direct situation and release the emotion against themselves.

A third type is somewhat similar to the second. In this case the individual does not feel that he is being blamed unduly or accused of acts or attitudes of which he is not guilty. On the contrary, he is guilty, he withdraws from the guilt, forgets it entirely, and directs the emotional tension originally attached to the guilt in every direction, since he believes innumerable other people to be guilty of the act which he himself has purposely forgotten. A simple illustration is the child who refused to go back to the first grade in school because everyone else was cheating, or the nursery-school child who refused to attend nursery because all the other children might bite him, when he was the only biter. Again the individual should be faced with his own guilt, made to accept it, and release the emotional content which is associated with it against himself and not against the individuals on whom he has projected his guilt or his faults.

As soon as the emotion has been released and the child has faced the facts and accepted them, he should have interesting activities suggested which will drain off the emotions aroused by the situation which he has just met and faced. To remain in a state of high emotional tension may make facing an unpleasant situation so disagreeable that the child's tendency to use escape mechanisms may be increased. The entire situation is supposed to help him develop a habit of facing facts rather than using escape mechanisms. Nothing will inhibit the formation of a habit more rapidly and accurately than the association with it of highly unpleasant results.

There are many instances of individuals who never analyze to discover the causes of their failures to meet situations. The individual who states that he would have won the

tennis game if the courts had not been too wet or if he had not had on the wrong kind of shoes; the child who in spite of good home conditions states that he cannot study because it is too noisy or too light or, the height of all absurdities, because he has no fountain pen, are all instances of the same mechanism at work. The child using this mechanism often allows himself to feel mildly or severely persecuted by the normal situations which every child or every adult has to meet. Children of this sort imagine themselves "picked upon." In its extreme form, this type of behavior develops into actual delusions of persecution, but many children even in early life begin to develop reactions of this sort which, if not checked, will result in asocial or anti-social behavior.

One of the most important things which the parent should give to the child is the technique of thinking straight; of meeting situations first by facing them clearly and then by analyzing the causes for their occurrence rather than by escaping through daydreams or through the making of excuses. No habit is more seriously detrimental to the development of an adjusted personality than the habit of shifting the blame for one's failures. This involves withdrawal of the self from an event which is unsuccessfully accomplished. It is a flight and escape exactly as much as if the child had taken to his heels when presented with a fearsome object. The emphasis in the training processes should be on helping the child to accept himself as the agent in an unsuccessful event and to obtain his security through an analysis to find the actual causes of failure. One can find instance after instance of such behavior as early as from two to two and one-half years of age, and it is then that training should be begun.

Blaming others is simply another phase of blaming things for one's inadequacies. It is equally detrimental as a behavior pattern. Here the child escapes from the situation by bringing in another person to take his place as the unsuccessful agent. If this other person is actually to blame, then the child may feel no insecurity. The failure and its consequent insecurity are referred to the new agent brought in.

Rationalization involves giving adequate but unjustifiable reasons for failures or for what the individual wishes to do but which, if he does it, will place him in an insecure situation. He escapes from identification of himself with a socially unacceptable motive by the introduction of a different motive which will be acceptable for the time and place. This protects him from the consequences of what he has done or intends to do. It makes him feel that he is secure. The flight here is from the motive, not from a total situation.

A fourteen-year-old was told to bring his five-year-old brother home from kindergarten on the streetcar which passed in front of the school. He was instructed not to travel on the bus, since there was danger of bus accidents. Returning home that afternoon his mother saw him get off the bus. His statement to her was, "but the bus passed so much closer to the pavement that I took it instead of walking all the way out to the streetcar and taking a chance on automobiles coming." Her reply was, "You really wanted to come back on the bus instead of the streetcar, didn't you? That was the real reason." This was said in a calm tone and with no indication that the child was not telling the truth. It was simply done to make him face the actual reasons for his behavior.

A three-year-old who was absorbed in playing with his blocks was invited to come in to play a game which was really a study of his learning process and which had been going on every day for a week. His response was, "My mother says I must stay in the sun all day so I can't." Being questioned, his mother said that she had never made such a statement. This was simply a rationalization on the part of the three-year-old. He did not wish to come in and therefore gave what to him would be an acceptable reason.

A three-and-a-half-year-old refused to take cod-liver oil presented in orange juice after he had downed the dose on the previous day. His statement was that he was afraid that he might spill it on his clothing and it might make a spot, though this had not occurred on the previous occasion. When orange juice alone was presented with cod-liver oil omitted, the child smelled it carefully and then drank it without any reference whatever to the fact that it might produce spots.

A four-year-old had been given an electric train for his Christmas present. On the afternoon of Christmas day, he was told to get ready to pay a visit to his grandmother. Immediately his response was, "But I can't go out. The weather is cold and wet. If I do, I'll catch cold. It is better for me to stay here in my own room and play." The actual motive was a desire to stay and play with his train rather than to visit his grandmother. This was unquestionably not an acceptable motive and would not have produced the desired result or if it had, would have produced it only after a struggle. He therefore substituted motives which might even place his mother in a peculiar position if she insisted upon his going out, and in this instance the reasons given produced a successful response on the part of the

parent. The situation should have been handled by a straight statement to the child that his real reason was his desire to stay home and play and that taken in the car and properly covered he would stand little or no chance of catching cold.

Instances of the use of rationalization are many even in the most normal persons. If one realizes that one is rationalizing, no harm is done. It is only when the truth is not faced that this reaction becomes harmful. The student who says to herself that she is going to the dance instead of studying for a quiz, the material for which she has not yet mastered, because she is sure that she is stale and needs a change of activity, may or may not be rationalizing, but the probabilities are that this mechanism is operative. The student working his way through college who goes in debt for a car because he wishes to use it for parties and who justifies himself by saying that it takes him to and from college more quickly and thus saves time for more studying is unquestionably rationalizing.

There are two other types of rationalization—one in which one withdraws himself from identification with the real motive for one's act, not by substituting a more acceptable motive but by saying that he had never had the desire, and the other in which one withdraws oneself from identification with the real effect. In the first, one says to oneself, "After all, I did not wish to have that car because it would have consumed too much gas and taken me too far away from home," or, "I did not wish to accomplish this piece of work because it would have meant added responsibility without added pay," or, "I did not really wish to make friends with this person," when in each case one really did wish the thing which one has just

disavowed. One feels insecure because one's efforts have met with no success. The next step is flight from the real desire and by this flight security is attained, for if one really did not wish success in the project and one has failed, then failure was the thing calculated to make one feel secure.

A three-year-old who had asked three times for a cooky in the middle of the afternoon, when this was not a customary feeding time, was refused, whereupon he said, "I hate cakes in the afternoon," and turned away. His two-year-old brother under the same conditions had said, "I was just teasing. I didn't want cakes." Both of these children were using the same mechanism for facing failure. They both denied their real desires, thus withdrawing or escaping from a temporarily insecure situation.

Withdrawing from the real effect which is in its consequence unpleasant and gives the individual a feeling of insecurity can be illustrated by the following:

Two children had planned over a period of two days for a picnic to take place on the afternoon of the second. Just before they left the house, a thunderstorm and shower came up and the picnic had to be given up. Disappointment would have been natural, but the mother of those children put them in the position in which they were forced to say, "After all, we like the rain better because it makes the flowers grow." They thus were forced to withdraw from contact with the real effect of the rain on their plans by being made to look at the effect of this same rain on the flowers. One almost never finds instances of the use of this mechanism on the part of young children unless it is initiated by adults. In the use of this mechanism, a deliberate attempt is made to distract the attention from

the actual situation and to direct it to another and more secure one.

Compensation is a result of a realization that one's desires cannot be achieved in an area in which success is desired. The child then withdraws from competition in this area because it is likely to lead to failure and the resulting insecurity and attempts to secure a similar success in another area. For example, a child who wishes to attract attention because of his strength may be unable, because of physical weakness, to stand out from his group. He may then secure the attention which he wished to secure through display of strength by making a noise. He may wish to be outstanding in an intellectual field but may, because of low-grade mentality, fail. He compensates for this if he is of good physical size by being a bully, by showing in the field of fighting that superiority which he cannot show in any field which involves intelligence. A child who is insecure for any cause may show off to restore to himself a feeling of security. In a word, he escapes from failure in one area to another in which success is more apt to result from his efforts. A child who has an unhappy home situation may show off both at home and at school. A child who is physically ill may turn his efforts to success in schoolwork, as may a child who finds himself unpopular.

It must be understood that a slight use of any of the escape mechanisms may result in no harm whatever. It must also be understood that the socially adequate individual faces situations, analyzes them to find out wherein his difficulties lie, and then either corrects his errors and goes on to success or seeks other outlets for his activity in a line in which success is more apt to be had. All individuals throughout life must have failures and must make mistakes.

It is facing the situation and finding security through meeting it which is normal adjustment—not using escape mechanisms.

Displacement is a mechanism which is frequently misunderstood. Here the individual has a fear so far removed from the usually accepted pattern of human behavior that he dares not face it, or he has a desire equally far removed from the socially accepted pattern. He does not face this even in terms of thought. It cannot then appear in consciousness except after the true Freudian fashion—in disguised forms such as dreams or trains of thought of which the child himself does not realize the purport. Such suppressed ideas continue to produce vague feelings of insecurity, worry, and anxiety which are accounted for in terms of various stimuli not really related to the situation or stimulus which produced the original fear. For example, a child may, because of unduly severe punishment, develop a fear state in regard to his father. All the traditions which surround him make it an unwise thing for him to show this fear and the dislike which often accompanies it. The real cause is therefore buried under this weight of ideas with which tradition surrounds the behavior of children. The child is unable to say frankly that he dislikes and fears his father. He may substitute for a frank statement to this effect and a frank acknowledgment of his true feelings a wholly antithetical set of actions. He may insist over and over again that he is afraid that his father will not come home, that he is afraid that his father will not meet him, that he is afraid his father will die or be hurt. Conflicts are produced in this way which must later be resolved before normal adjustment can be attained.

A four-year-old boy showed definite fear of all men except

his father. He did not withdraw from his father but on the contrary said over and over again during a nursery-school day, "I am afraid my Daddy won't come for me." "When will my Daddy come?" "My Daddy is sick." When his father finally came, he would leave with him, but he would say, "My Daddy won't come for me tomorrow." The father had, through severe punishments, set up a fear and flight reaction. The mother and the rest of the child's family had insisted that all good little boys loved their fathers, that his father was good to him, and that he must love his father. He therefore repressed the whole complex of fear reactions and substituted in place of these fears, fears that his father would not come or of his father's illness or accidents, since these were acceptable social reactions, and withdrawal from or dislike of his father were not.

A case of the writer's, a four-year-old child, behaved in much the same way in regard to his grandmother. He was constantly assured by his family that all little boys loved their grandmothers, that it was wicked to say that he did not like any of his family and particularly his grandmother, that he was an unnatural child. This led to the relegation of the whole matter to the subconscious mind. The child, however, said over and over again that he hoped his grandmother would come to see him, that he loved his grandmother, that he was afraid she might get sick. His dreams were characterized by the usual degree of repetition. He dreamed frequently of a large black animal that came to the door and demanded that he come out and kiss it. He said the family liked the animal and petted it but he wished to kick it but could not. The dream disappeared and the child showed far less irritability and general upset when the suppressed ideas were finally brought to light.

The method of repression discussed by Jones (11) has as one of its worst results that it leads to the relegation of ideas to the subconscious, with the consequent train of abnormal activities and emotional upsets.

Repressed ideas may lead to the development of symptoms which will enable the child to escape from the situation about which he does not wish even to think. The child who develops headaches and nausea to escape from school may develop these on the basis of repressed ideas. Symptoms may in themselves be a means of escape and, if they are successful, may be the way in which the child refuses to meet life situations. If any task is too difficult or too uninteresting, he develops a headache or a pain in his arm, or a stiff neck, or some other symptom which will serve to let him evade the task which otherwise would have to be accomplished. This is in itself an escape mechanism and one all too frequently met with in the neurotic child.

Jealousy. As an instance of the modified form of emotion which probably comes out of fear,* we have jealousy. Jealousy has its rise in lack of security in connection with persons. This emotion is not present where the child has been conditioned in such a way as to feel that his place in the family and the social group is secure. Jersild (8, 9) cites the case of two children who actually wished the death of younger brothers and sisters. This behavior is common; in fact the types of reaction which have their bases in this emotion range all the way from refusal to eat except when fed, or otherwise given the attention which cannot be gained in any other way, to such behavior as is described by Dr. Taft (18) in the following paragraph.

* The child loses his sense of security in regard to persons in the home and reacts with a complex of emotions which we term "jealousy."

Some jealous children become timid, repressed and shut in, and, feeling that they do not have the approval of the parents, do not trust their own ability to win approval from those outside of the family. Still others assert themselves violently, become over-bearing, self-centered, domineering in their efforts to make up for the painful sense of failure at home, or develop a chronic grouch, a depressed or antagonistic attitude toward the universe, and a delight in picking out the faults of others.

Individual children seem to react in entirely different ways. One of the cases cited by Dr. Taft (18) indulged in threats of suicide. A case with which we have had experience developed the idea that she must be a child just brought in to live with the family, that she could not be her mother's child. Out of this attitude grew both resistance to authority and a tendency to crying spells and depression. This is a somewhat unusual case, but enough material has been cited to show that jealousy in young children causes many peculiarities in behavior which may result in the development of highly undesirable characteristics of personality.

Sometimes the jealousy arises because the child has been the center of attention for four or five years, a new baby has come, and the child is no longer the center of attention in the household. The new baby's coming will often produce the jealousy all the more strongly if no one has prepared the older child for its coming. Adults, both outside and within the family group, often point out to the young child that he is no longer mother's baby, and this, of course, adds to his discomfort. That jealousy may not come as a result of the arrival of another child in the family is proved both by common observation and by an instance which is cited by Watson.

The child B, who was two and a quarter years of age at the time when his baby brother was born, was brought in to see the child. He appeared

to be very much interested in the baby. He patted the baby's hands and rubbed his hands over its head and face, saying, "That baby, that baby." The only time at which he appeared to react with an adverse emotion was when the trained nurse attempted to take the baby from his mother. At this time he protested, saying, "Mama take baby." Even when B had to leave his room in order to let the new baby have it, he showed no jealousy: on the contrary, he assisted in pushing the furniture out of his room. Jealousy never appeared in connection with the new baby except when a new nurse attempted to control B by saying, "You are a naughty boy. Jimmie is a nice boy. I love him."

Recently the writer observed an excellent case of conditioning. Two children, two and a half and four years of age, respectively, were taught to look forward to the coming of a baby "as big as a big doll." They put aside some of their toys for it and always referred to it as "our baby." When the baby was ten days old each child paid it a visit at the hospital and both helped to prepare its crib and its room. No jealousy has ever developed. The wise treatment has been continued and the third child, now three years of age, has always been looked upon as a great addition to the pleasure of the other two, who feel the responsibility for her keenly.

There appears to be no correlation between the degree of intelligence and the degree of jealousy in individual subjects, though Smalley (16) found more jealousy in the duller of two siblings than in the brighter. Our own studies of 100 jealous children indicate that there is no correlation between any characteristic of personality and jealousy. Foster (5) states that pugnacity, fears of a neurotic character, selfishness, and fixations on parents were found more frequently in the jealous group. He also points out that there are more of the behavior problems of infancy, sleep disturbances, enuresis, destructiveness, and so on in such

cases. In our cases these problems were the result of jealousy, not its cause or its correlate. Children conditioned to jealousy, as we have already pointed out, tend to have every variety of behavior problem. These problems are either an attempt by the child to restore himself to his place in the family or are used by the child as a means of escape from the insecurity produced by the treatment which he is receiving.

No child who is experiencing jealousy remains in a stable emotional condition. On the contrary, this form of fear is a major factor in the production of behavior problems of every kind.

The techniques used by Markey (14) to study jealousy are in common use in all laboratories where studies are made of the emotional life and personal development of young children. They often reveal repressed jealousies of a dangerous sort.

Jealousy is one of the most serious aspects of fear inasmuch as to lose security in connection with the objects of one's affection is the most severe of all losses. It may be serious enough in its effect to cause the child either to attempt to destroy the individual producing the jealousy or to plan for his own destruction or injury. Writers are all too prone to neglect this factor as an underlying cause of obsessions and of compulsion neuroses. A case of the writer's went around and around his crib every night touching each post until he became dizzy. This was done to ensure affection from his mother on the following day or to ensure that his mother would kiss him good night that night. The contemplation of self-destruction by young children, *i.e.*, children between the ages of four and seven, is far from

unheard of. In a world which is largely insecure, unless the children are well conditioned, loss of support from the adult on whom they depend makes facing the world too difficult. A secure world is an essential part of the development of sound personality in early childhood and later life. Neurotic symptoms which do not show clearly until adolescence may be developed on the basis of early jealousy. Attitudes toward marriage and family life may show a picture of complete maladjustment because of failure to resolve the jealousies developed before the age of six.

This form of fear cannot be dismissed as a factor in producing maladjustments in the field of the instinctive drives as well. A too strong emphasis on the desire for power can often be traced to loss of security in infancy and early childhood. Maladjustments in the field of sex also have their rise in this emotion.

The writer is of the opinion that jealousy in young children is all too frequently produced by the behavior of the adults toward them. The adults suggest the reaction of jealousy toward the new child or toward one or both parents.

Jealousy may be the result of too much attention on the part of one parent, or it may have other causes. Whatever the underlying cause it should be discovered, and the wrong attitude engendered by this unhealthy emotional state should be reconditioned. Such reconditioning involves both a change in the factors which have produced jealousy and new interests and activities as a substitute for the behavior which it has caused.

EXERCISE

List the number and kinds of emotional disturbances which you have observed in the subject studied.

What appears to cause fear? (Use no means to arouse this emotion.)

How often have you observed fear since observation began?

Note clearly whether there are any changes in the number of fear states and in the stimuli which produce fear as your subject matures.

List and describe the use of any escape mechanisms which you have observed in your subject.

Compare the behavior of your subject in regard to the use or absence of escape mechanisms with at least three other children of the same age.

If you have noted any experiments in reconditioning fear states with your subject, describe carefully all the procedures used and the results obtained.

Bibliography

1. Arlitt, Ada Hart: "The Child from One to Twelve," Part IV, McGraw-Hill Book Company, Inc., New York, 1931.
2. Cannon, Walter B.: "Bodily Changes in Pain, Hunger, Fear and Rage," Chaps. I–II, D. Appleton-Century Company, Inc., New York, 1929.
3. English, H. B.: "Three Cases of the Conditioned Fear Response," *Journal of Abnormal and Social Psychology*, **24**: 221–225, 1929.
4. Felder, J. G.: "Some Factors Determining the Nature and Frequency of Anger and Fear Outbreaks in Preschool Children," *Journal of Juvenile Research*, **16**: 278–290, 1932.
5. Foster, S.: "A Study of Personality Make-up and Social Setting of Fifty Jealous Children," *Mental Hygiene*, **11**: 53–77, 1927.
6. Goodenough, Florence L.: "Anger in Young Children," University of Minnesota Press, Minneapolis, 1931.
7. Goodenough, Florence L.: "Experimental Child Study," D. Appleton Century Company, Inc., New York, 1935.
8. Jersild, A. T., and F. B. Holmes: "Children's Fears," *Child Development Monographs*, No. 20, Teachers College, Columbia University, New York, 1935.
9. Jersild, A. T., and F. B. Holmes: "Methods of Overcoming Children's Fears," *Journal of Psychology*, **1**: 75–104, 1935.
10. Jones, Harold E.: "Fear," *Childhood Education*, November, 1928, pp. 136*ff*.
11. Jones, M. C.: "The Elimination of Children's Fears," *Journal of Experimental Psychology*, **7**: 383–390, 1924.

12 JONES, M. C.: "Emotional Development," in Carl Murchison, editor, "A Handbook of Child Psychology," Chap. VI, pp. 271–302, Clark University Press, Worcester, 1933.

13. LAY, WILFRID, "The Child's Unconscious Mind," Chap. V, Dodd Mead & Company Inc., New York, 1919.

14. MARKEY, F. V.: "Imaginative Behavior in Preschool Children," *Child Development Monographs*, No. 18, Teachers College, Columbia University, New York, 1935.

15. RASMUSSEN, VILHELM: "Child Psychology," Vol. I, Chaps. VIII–XIV, Alfred A. Knopf, New York, 1923.

16. SMALLEY, R. E.: "Two Studies in Sibling Rivalry, Part II: The Influence of Differences in Age, Sex, and Intelligence in Determining the Attitudes of Siblings Toward Each Other," *Smith College Studies in Social Work*, **8**: 241–248, 1930.

17. STERN, WILLIAM: "Psychology of Early Childhood," Chaps. XXXV, XXXVI, Henry Holt and Company, Inc., New York, 1924.

18. TAFT, JESSIE: "Early Conditionings of Personality in the Preschool Child," at Schoolman's Week, University of Pennsylvania, March 27, 1925, *School and Society*, **21**, (546).

19. VALENTINE, C. W.: "The Innate Basis of Fear" *Journal of General Psychology*, **37**: 394, 1930.

20. WARREN, H. E.: "Elements of Human Psychology," Chap. IX.

21. WATSON, J. B.: "Behaviorism," Lectures-in-Print, Lectures VII, VIII, W. W. Norton & Company, Inc., New York, 1930.

22. WATSON, J. B.: "Psychology from the Standpoint of a Behaviorist," Chap. VI, J. B. Lippincott Company, Philadelphia, 1919.

23. WOOLLEY, HELEN T.: "Overcoming Contrariness and Fears in Children," *Hygeia*, March, 1924, p. 164.

INNATE RESPONSES AND TENDENCIES TO RESPONSE

C. THE EMOTIONS *(Continued)*

WE HAVE STATED PREVIOUSLY THAT THERE ARE THREE primary emotions—love, anger, and fear. Since anger and fear are closely related as to their physiological accompaniment, anger follows logically as the next of the primary emotions to be discussed.

Anger. The bodily changes which occur in anger appear to be very similar to the bodily changes occurring in fear states. Anger, as has been said, differs from fear in its external manifestations, in that the attitude in the fear state is to shrink back, to hide, to run away, while that in the anger state is to go toward and strike. The infant experiences anger a few hours after birth. The stimuli to anger are much less specific than are those to fear. Anger appears to be aroused by anything which thwarts the individual. Any obstruction of movement appears to produce this reaction, as, *e.g.*, holding the child's arms or interfering with his breathing by holding his nose for a very brief period.

The methods of setting up anger states appear to be the same as those which set up fear states. Anger may be

set up by direct conditioning, *e.g.*, if a child has been thwarted by the same individual a number of times, the anger attaches itself to this individual to such a degree that the appearance of the individual at the door is sufficient to cause anger to appear. An experimenter who had worked with a baby for the presence of anger by holding the child's nose for brief periods on several successive days found that when his face came in the range of clear vision, the child began to cry and to show other signs of anger.

Anger may be set up by transference. A child who has been overcontrolled and, therefore, thwarted by a nurse may react with a temper spell to the name "nurse" or to any nurse or to a special costume which the nurse has worn. One has frequently, as an adult, the experience of reacting with irritation and dislike to a person whom one has never before met. Individuals similar in appearance to this person have thwarted the adult at an earlier date and the emotional state transfers now to the new individual because of some similarity in facial expression, gait, general appearance, or the like.

There are all too frequent illustrations of the transfer of anger spells from the particular administration of discipline to all administration of discipline and to all authority. A child who has had anger aroused constantly through the poor administration of authority in his home may react to authority as expressed by the city or state or to authority as exemplified in the person of his employer with exactly the same types of reaction as those to which he was conditioned in early childhood in his home.

Anger is very easily set up verbally. If the child has confidence in the adult with whom he is coming in contact,

the very statement to him that this is a thing which makes children angry or should make big boys angry is frequently sufficient to make him attach anger to that situation. This method may be used for both conditioning and reconditioning anger states. In the presence of specific situations, one says: "We do not get angry at that"; or "All big boys get angry when little children are bullied"; or "Big boys do not get angry with boxes that are too heavy to move," and similar statements. If the child has confidence in the maker of such statements these cause the attachments and detachments of anger states.

Imitation is frequently the cause of anger states. The child sees its mother furiously angry with a peddler who comes to the door and interrupts her at her work. The sight of this peddler thereafter may produce anger. A child may be lead to show anger at the most trivial circumstances if he is given constant examples of anger reactions by the adults who are responsible for his behavior.

All of the methods which are listed as initiating fear states are equally operative in conditioning anger, since the fifth method on our list in the chapter on fear is merely another phase of the use of the method of verbal association.

The methods used to recondition fears may also be used in reconditioning anger.

The method of disuse, in which the object of the child's anger is kept away from him over a sufficiently long period to have the whole complex drop out, does appear to be effective to some degree as a method of reconditioning anger, though it has been shown to be almost wholly ineffective as a method of reconditioning fear.

The method of negative adaptation again seems to be slightly effective in the case of reconditioning anger states, though its effects are practically negative in the case of fears. The child, however, does not often "get used to" objects which have produced anger unless other methods are employed, particularly the method of social imitation.

Verbal appeal as a method of reconditioning anger states, while not so effective as are some of the other methods, may yet be used with some degree of success. Children who have had anger aroused in connection with a member of the family may have this anger reconditioned when the person toward whom anger has been directed has been made sufficiently interesting in his absence. Discussion of the peculiar or interesting characteristics of the person may result in so conditioning the child that he looks for these rather than responding with a temper spell when the person appears. No such absurd process of verbal conditioning as telling a child who is angry with his grandmother how good the grandmother is can, of course, be effective, since mere goodness in the abstract has no appeal for children if, indeed, they have any idea what is meant by the term. The verbal association of a treat with the grandmother later followed by the treat itself will almost certainly be effective, and the mere verbal association of the treat may be sufficient to detach the anger even before the treat has been given.

The method of distraction does not work, if the temper spell is allowed to get under way. On the contrary, here again the child attends so closely to the train of organic sensations which make up the emotion that his attention cannot be gained for the less intense stimuli which are

presented to him. If one is sufficiently skillful to distract his attention before the anger spell has developed to any extent, distraction may be operative as a method of reconditioning.

The method of repression is as unfortunate in its effects when used in connection with anger spells as it is when used in connection with fear. As has been discussed fully in connection with the escape mechanisms, repression of anger states may produce a sense of insecurity. It always produces conflicts which must be resolved before adequate adjustment can be made. Repression merely means that the child does not face the actual cause of his anger and he must therefore make use of escapes in order to restore his own equilibrium or he represses the emotion in connection with this situation and transfers it to all other situations that he perceives as similar.

The method of social imitation is constantly in use in nursery groups. Children find that other children do not become angry and bite each other when a favored toy is not given up, that, on the contrary, they use a substitute reaction—that of asking for a turn with this toy. This reaction in time comes to be substituted for physical violence, and it may then be said that the anger state has been reconditioned by the method of social imitation. Illustrations of the use of this method are too numerous to mention. Any observer in a nursery group may list a half dozen instances of this behavior in a single morning.

The method of direct reconditioning is one frequently used by parents and other members of the child's family. The child has shown strong anger and irritation at an uncle. The family therefore plans that the uncle shall take the

child to the zoo for a trip and thus associates pleasant results with an object which originally gave rise to anger.

From early infancy the conditioning of anger states should be taking place. Outbursts of temper should be few in number, and these should decrease as the child grows older. One of the main problems of education is to attach anger reactions to the right situations, since anger is a force which can be utilized most productively. An individual working under the stress of anger will often accomplish results impossible in a calmer emotional state. The biological purpose of anger appears to be to increase energy, in order that the individual can overcome obstacles or conquer objects which would present almost insuperable difficulties without the added energy which the emotional state gives.

Temper Tantrums. Temper tantrums seem to develop as an outgrowth of various conditions. They appear to come at times as a result of overstimulation. Children are taken about overmuch, kept out late at night, made to show off too frequently—any one of these or many other causes of overstimulation may result in temper tantrums, which sometimes appear to disturb the child himself as much as they do others. The tantrums may come as a result of physical conditions other than the fatigue and strain which come from overstimulation. A third, and probably the most frequent, cause is the use of the temper tantrum as a means of securing attention or of dominating adults or other children. This type of temper tantrum may develop on the basis of either or both of the two causes stated above, or it may develop independently. Children who have first given way to violent outbursts as a result of physical disturbance may find that these outbursts in-

variably have as their outcome the offer of new toys or bribes or other sorts of satisfactory adult behavior. The temper tantrums may then persist long after the underlying physical cause has been removed. A little girl of five was brought in for psychological examination because, to her father, her behavior appeared so peculiar as to be abnormal. When faced with anything which she did not wish to do, or when asked a question which she did not wish to answer, the child clapped her hands to her head and began to scream. At approximately the age of two, the child had not been well. Her parents had been cautioned against overexciting her, and, in consequence, when she complained of pain or of a headache, she was allowed to have her own way. The child had apparently associated the pain in her head and the screaming with which she accompanied it, with the pleasurable result which followed—the ability to have her own way. The habit had become fixed, and the child was controlling both parents by means of the screaming fit and the supposed headache at least two years after the disappearance of the physical basis upon which this habit had been set up. The child's physical condition was fairly good when she was seen by the psychologist, though there appeared to be some digestive disturbances as a result of the tantrums. Both the screaming fit and the headache complained of were overcome after approximately six months' training.

Our first attack on the problem, when a temper-tantrum child comes under observation, is to determine the cause. Some of the causes have been cited above. Other factors may be responsible for this type of behavior. If the cause be physical, have the necessary steps taken to cure it. If it be that the child is using the tantrum as a means of

securing attention or gaining his ends, the cure is suggested by the cause. Children who use temper tantrums for the reason last given should never secure either the desired attention or the adult compliance with their wishes for which the temper tantrums were used.*

In the discussion of the escape mechanisms in the chapter on fear, it was noted that the same mechanisms were also used in the place of actual aggressive reactions in anger states. In a word, the child, instead of actual attack, attacks in ideational terms, just as in fear states he runs away in terms of ideas instead of actually taking flight or withdrawing.

Daydreams are the mechanisms most frequently employed to solve situations not otherwise possible of solution. The child is thwarted in his home. He cannot expect to oppose his strength to that of adults because of obvious physical disparity. He therefore images himself as meeting them and coming out ahead. He dreams that he is now large and his father or mother small. He may dream of himself as ordering the smaller person around in the same way in which he himself has been ordered around. This is simply another illustration of the "conquering hero" mechanisms now used for aggression, not escape.

A three-and-a-half-year-old who had been hit by a larger child did not respond by fighting, but as soon as the other child was out of hearing, said, "I'll kick him and bite him.

* Recently the writer has had contact with several cases in which temper tantrums appeared to have developed as a result of overcontrol. Domineering adults who refused to allow any choice in the children's responses, who insisted on immediate and unreasoning obedience, and who controlled the children even in the so-called "free play" periods appeared to have been responsible for these tantrums. In each case the tantrums have practically disappeared when the overcontrol stopped.

I'll stamp on him. I'll pull off his ear," and having worked out his war against the larger child in terms of fantasy, he went back to his play without further attempt at response.

Such statements on the part of the child as, "I'll kill you," or "You're dumb," or any other statements which are intended to put the older person in the wrong or to hurt him are in the nature of defense reactions. A child whose anger has been aroused time and again without proper outlets will frequently look for and find the one thing or things which disturb the parents most, and then will do these things. If the child can put the parent in an untenable position by what he says, or can hurt the parent's feelings, or embarrass him, he has defended himself as well as if he actually used his fists. He has substituted verbal defense reactions for the actual use of physical violence. When these reactions are substituted only in the dream world, that is to say, when they find no outlets verbally they permit the child to withdraw from the situation and come out victor as he never could in reality. When they succeed in embarrassing or disturbing the parent because they find outlets in speech or overt activity, they then bring the child in contact with reality and give the full fruits of the victory over the actual situation. The "conquering hero" mechanism described above refers solely to the daydream pattern of response.

The reverse of this pattern, the "suffering hero," is frequently exemplified in the child who actually dreams himself dead and goes over in fantasy the sorrows of his parents over his early demise. By thus imagining himself as producing suffering and remorse in his parents through his own suffering and death, he comes out as conqueror.

The situation which it was impossible to handle in reality is now handled simply enough in the daydream world.

Rationalization may be used to enable the child to come out a victor in the situation in which he cannot otherwise succeed. Giving unjustifiable but adequate reasons may actually enable him to gain his end when a true statement of the situation would result in defeat. This mechanism may be used to direct anger away from the child and toward other individuals. He realizes that were his true motive known, irritation and anger at himself would result. He, therefore, substitutes an entirely different motive which will allow him to become angry with and to feel superior to the individuals who might otherwise criticize him. In a word, he defends himself against criticism by the substitution of a socially adequate for a socially inadequate motive.

Projection may also enable him to win by projecting on another agent all blame for nonsuccess. Wherever these mechanisms are used in the place of aggressive reactions, they become substitutes for external fighting movements. Faults and mistakes in others become the child's defense. Fighting is unnecessary if the fault can be placed elsewhere and the child become no longer the agent.

The individual may defend himself as well with a series of such reactions as those listed as previously he defended himself with his fists. Escape mechanisms may, and easily do, turn into defense mechanisms. They are equally ineffective as methods of adjusting to reality.

Anger should be trained to such a degree that it functions only when its functioning is socially desirable. It is perfectly possible for the adult so to condition a child

that he responds with anger only in situations in which that anger will release sufficient energy to enable him to overcome obstacles. Both anger and fear have as their biological significance the production of additional energy for fighting or for escape. Individuals under the stress of anger often accomplish tasks which would otherwise appear to be impossible. Everyone has had experience with groups who accomplish nothing in the way of civic and social reform until aroused to anger, after which time they sweep everything before them. A child blocked in carrying out his purposes should be able to release additional energy, where that is a desirable factor, in overcoming the obstacles which stand in his way. Anger at undue interference of any kind is essential if children are to gain the full advantage of group contacts. Lack of normal aggressive reactions with their accompanying anger states results in over-suggestibility and in other social maladjustments.

The writer has had experience with children who were so conditioned against anger that they allowed other children to take from them even their most coveted toys. A three-year-old had a two-year-old brother to whom she had been forced to give up throughout the two years of his life, while at the same time she was being conditioned against anger states. She was taught never to take up for herself no matter how much she was imposed upon. The children in the nursery group discovered this absence of normal aggressive reactions very quickly and in no time were taking from Jane every toy to which she became in the least attached. Her play periods were broken into before they had lasted more than a minute or two by some more aggressive child who wished to play with whatever Jane was using. In this case, it was necessary to teach the child

to fight, to condition her to a normal amount of anger, with its accompanying aggressive and defense reactions.

The attitude toward reconditioning anger states is, therefore, the reverse of that toward reconditioning fears. In the case of fear, the object is so to condition children that they will have fear rarely if at all, even in the presence of danger,* whereas in the case of anger our object is not to condition children against this emotion entirely, but to attach it to situations in which it is socially desirable and to detach it from situations in which it is useless or even harmful.

Love. Though Watson (15, 16) has given certain of the pattern reactions which occur in response to the stimuli to this emotion, the emotion as it is seen in human beings, except a few hours after birth, is so clearly the result of conditioning due to environment that it is almost impossible to study the emotion apart from its conditioning factors. Love as it occurs in the young child apparently comes out of the dependence which the child feels upon his mother or the other adults who wait upon his comfort. Many authors have stated that love occurs in response to patting or stroking or to any other form of physical contact which brings satisfaction to the child. Certain it is that there is no definite set toward any particular member of the child's family at birth. Anyone who attends to the physical care of the child can bring out the love reaction. It is not at all unusual to have children show more affection for their

* It cannot be emphasized too often that fear and caution represent two entirely different mental states. A cautious driver can pilot his car through a severe traffic jam where a driver in a state of extreme fear is temporarily helpless. Children should be taught caution in the presence of danger. Extreme fear renders children helpless and therefore puts them at a complete disadvantage.

nurses than they show for their mothers. Parents who have gone off on a trip and have stayed for several months are frequently surprised to find that the young baby's reactions to them are no longer operative. In the short time during which they have been away, the love reactions have focused on the adults who have had charge of them and the short memory of the child has resulted in the dropping out of the overt responses toward the parents to which he had been conditioned earlier.

Recently there has arisen a viewpoint peculiar to one group of psychologists, which confuses love,* an emotion, with lust, a definitely appetitive function.

It might serve to obviate this confusion, lest persons not conversant with either psychology or physiology should become uncertain as to the nature of an emotion, to point out that appetites arise in connection with definite organs, while emotions are the result of a coordinated series of reflexes present at birth and under the control of the autonomic nervous system plus a greater or less amount of ideational content. Thus sex drives and sensations arise in connection with stimulations of the sex organs and other erogenous zones, usually the mouth and breast areas, while hunger arises in connection with the churning movements of the stomach and thirst in connection with definite organs in the mouth and internal areas. Love, on the other hand, is a series of coordinated reflexes controlled largely by the cranial division of the autonomic nervous system plus the perception of these changes together with the ideational content and the stimulus in response to which both appeared.

* See Ruch, Floyd L., "Psychology and Life," Scott Foresman and Company, New York, 1941.

When the individual is in love, if it be love and not excitement, he is in an excellent physiological state. Digestion is at its best, the salivary flow is normal, the peristaltic contractions are balanced, neither too rapid nor too slow. The general emotional tone is highly pleasant. When the sex drive is functioning at its height and before it has been integrated with the emotion love, none of these effects may appear. On the contrary, an individual driven by the appetitive sex drive may find a large number of physiological changes not of a pleasant nature. The general tone may be excited and there may be a rapid shift from the sacral to the central division of the autonomic system, in which case anger, fear, and excitement may alternate with the sex drive. Only when the sex drive is a part of the emotion love does a general sense of security also appear.

To confuse lust with love is to fail in a knowledge of both the physiological processes and generally accepted scientific terminology. It is common knowledge among individuals who have done research in the fields of sex education that the sex drive as a drive and unaccompanied by the emotion love is no basis for marital adjustment. On the contrary, unless the sex drive has become integrated with the emotion love, the individual is not a good marriage prospect. The sex drive unattached may function in a generalized way and the marriage partner be one of a series rather than the only stimulus to its functioning.

The integration of the emotion love with the sex drive occurs in adolescence, as we have pointed out previously. Frequently it occurs so suddenly as to produce shock. The individual feels all the general physiological and psychological changes which underlie the emotion love and is suddenly aware of sex as a part of this emotion.

Heretofore, the emotion love has been experienced by itself and attached, as we shall later see, to a number of stimuli which change as the child matures. The total reaction is to be described as "falling in love," the generally integrated sex-love pattern which underlies stable marriage relations.

Too much exercise of the sex drive apart from the emotion love previous to adolescence, and this does occur in a certain percentage of growing children, may make it impossible to integrate the drive and the emotion. Where this occurs, as we have previously stated, stable married life is practically impossible. The emotion love then reverts to the narcist state, in which the individual is sex-fixated and selfish in regard to all other relationships while the sex drive behaves as it would in early infancy, if aroused at that time; *viz.*, it may, and frequently does, function in connection with any available stimulus of the opposite sex.

The child in his emotional development passes through what appear to be definite phases in which the central point of emotion changes. His emotion is attached to a number of individuals but shifts as to its focal point or point of highest intensity.

Every child passes through a series of definite stages in the development of the emotions centered in what we have termed "love" (10). The child has, as a central point for affection in the first year of life, himself. His own physical needs and physical comfort occupy so large a part of his attention that little is left for the outside world until the end of the first six months. By this time there should be a gradual transfer made to outside individuals.

The child first centers his affection on the mother if the normal amount of association between the two has

occurred. One has many occasions to see the devotion of the young child to his mother during the first five to eight years of his life, and this affection is in most cases entirely normal. Affection may transfer to the teacher in cases where there is an identification of mother and teacher on the part of the child. Between the ages of five to eight, or even earlier, there is a gradual transfer of affection on the part of the boy from the mother as the central point to the father. At twelve or near that age, the child's interest transfers to the gang and his emotional life is largely bound up in gang affairs. His affections are more nearly involved in the concerns of the gang or in some outstanding member of the gang than they are in any of the home individuals. Between fourteen and eighteen there may be a prolongation of this stage with some older hero as the central point, but during this period interest in girls is developing. By eighteen there should be a complete transfer to individuals of the opposite sex.

During the preschool period, there are certain abnormalities which may develop if children are not allowed to progress normally through the stages in emotional development outlined above; the child's emotional life may be concentrated on himself; affection for the mother may not develop satisfactorily; or too much affection may be concentrated on the mother.

Because of this last and for other reasons cited below the boy may not transfer his affection to his father at the proper time and may remain in the state of infantile mother fixation mentioned above.

The first type of abnormality which may develop in the love life of the young child is self-fixation. Too much atten-

tion should not be called to his physical condition and functions nor should too much time and energy be devoted to that all too common practice among parents, "dressing up" the child with the accompanying overemphasis on the child's health or personal appearance. Overhandling or unwise handling may produce this result. All of these may and sometimes do lead to self-fixations, which are natural enough in early infancy but which should be outgrown by three and a half to four years of age.

The boy should have the normal amount of physical care from his mother or from some other woman in the family if he is to pass through the second stage normally. A three-year-old boy whose father had taken over his physical care due to the fact that the mother had been ill during the child's infancy showed abnormal affection for his father. When his mother appeared to get him from the nursery, his first words were, "Where's Daddy?" If hurt at any time, he called immediately for his father. He showed almost no interest in girls but was overly affectionate with boys in the nursery. The mother was advised to undertake the physical care of the child and to cut down to some degree the overdisplay of affection between father and son inasmuch as, at three years of age, this child was obviously being conditioned to respond with love reactions only to members of his own sex.

The next stage at which abnormalities may occur is the point at which the child enters school. Many mothers fight against any influences outside the home in order to keep children in a state of dependence upon home affection. They lavish affection upon the children, become overdemonstrative, give the children many excuses for staying away from school, and often find the strain of having the

child away from them so great that they remove him from the group in which he has been placed.

The mother of a three-and-a-half-year-old, who was entered in a nursery school, insisted on spending the entire period of the school with the child. On being told that this was not for the child's best development, the mother wept bitterly and precipitated an emotional scene in which the child was kissed and petted for upward of a half hour. She was finally persuaded to leave the child in the school but, from that point on, she found excuse after excuse for keeping him out or for getting him before the end of the session. The boy himself began to give excuses for getting out of school. He had to go home and help his mother, he felt sick, and once for three days in succession he had a "bad earache." The mother was finally told that she must cooperate with the school or she must withdraw him, since the conflict was making the child irritable and even causing him to lose weight. On being given an ultimatum, the mother took this as an excuse to remove the child. The following year she entered the child in a kindergarten but withdrew him in three days and ran a so-called "kindergarten" of her own. The year after, she entered him in the first grade, where he was allowed to stay only a week. At the present moment, the boy is kept at home with a tutor. The serious outcome of this for his emotional life at adulthood is obvious.

The mother may react as strongly against the child's transferring a portion of his affection to the father as the mother just cited did to the child's breaking some of the habits which bound him too closely to her. One has instance after instance of a struggle on the part of the mother, who may even resort to bribery and to buying of the child's

affection. Where this struggle goes on, the child is not allowed to mature normally and he may, and frequently does, develop a mother fixation. It is, of course, possible for the father to refuse to allow the transfer to take place because he does not wish to be bothered or to prevent the transfer by his sternness and by undue severity in discipline. Whatever the cause, when the transfer is prevented, normal emotional maturity is blocked.

The later possibilities of blocks in normal emotional development occur so far beyond the preschool period as to warrant no discussion here, but those blocks which may occur earlier should be kept in mind by all who deal with young children. Every child must pass through earlier phases normally if he is to reach emotional maturity.

The emotional maturing of girls takes much the same line of development as does that of boys. There is a slight difference in the ages at which the transfer of affection is expected to occur, except in the case of self-love. The mother occupies the first place until approximately six years of age, the father from six to nine or ten, schoolmates from this time to fourteen or fifteen. There is a return for a brief period to the father, and from this period on the affection is for individuals of the opposite sex, terminating in affection for the life mate. Here, as in the case of the earlier discussion, too much stress must not be placed on the age limits set. These may vary by two years without producing serious consequences. The boy's affection may transfer to his father by six and a half, the girls by five, or a year's delay in the transfer may occur. These transfers are not sudden but gradual and may take several years to become complete. The ages listed are suggestive, not

final. This should be kept clearly in mind in the interpretation of child behavior.

The same difficulties may occur in the preschool period as before cited in the case of the boy. The girl may fixate her affection upon herself. She may fixate it upon her mother and not transfer it to the father. A child may be kept too long in her home and therefore not be able to have sufficient outside contacts to break the so-called "nest habits" to which Watson and others refer. Both she and the mother may struggle to keep her in the home and she may develop, as may the boy, all sorts of symptoms which will keep her out of school and in the home in which she is overcoddled and spoiled.

A five-year-old child who was placed in kindergarten developed nausea which resulted in her being sent home day after day. When this was overcome, the symptom shifted and she developed a headache and, finally, such severe crying spells that the teacher became as worried as was the mother. Investigation of the home conditions disclosed the fact that the mother was constantly begging the child to stay with her, spoiling her, paying her for saying that she liked to stay home better than she liked to go to school, and in other ways producing constant stimuli to refusal to stay in the school situation. A four-year-old boy so treated developed a pseudo neuritis on the left side.

A three-year-old girl in the nursery school was saved from this kind of treatment only by the fact that her mother was referred to a textbook which showed in no uncertain terms the effect of such treatment on young children. Only a few parents so emotionally involved are

willing to read material which reflects on their treatment of their children. For the most part, such parents tend to develop defense reactions of the type cited in the section on anger and to use these defense reactions to justify themselves in the stand they have taken, while at the same time they keep their children with them.

Difficulties may occur when the child attempts to transfer her affection to her father. This may be fought by the mother as in the case of the boy, and the father may refuse to accept the affection which the child wishes to bestow upon him.

Groves (10), in discussing this problem of the relative difficulties in the maturing of boys and girls, says, "It is not strange that the facts as gathered by those who have to do with the neurotic problems of women seem to point to the conclusion that girls more easily and more frequently than boys remain for too long a time in the stage of mother love. The evidence at present suggests that the stage of father fixation is built upon the earlier mother affection. The girl carries over her affection in a way the boy does not need to do, for in his case, the relationship is not merely a change of affection; it is also different in quality and contains the element of idealization of the father's activities. It is the desire for achievement that seems to give motive power to the boy's changing from mother to father." Whether or not there is a difference in the degree to which girls and boys tend to develop problems in this sphere, the conditions which produce these problems should be avoided by both parent and educators.

Out of the infant's love for its parents, as can be seen from the preceding discussion, are developed the many

types of affection which one finds in early childhood, in youth, and in adulthood. Variations of the type of affection occurring particularly at late adolescence are developed in connection with the emotional states surrounding parenthood.

There appears to be some danger of too much coddling and petting of young children, but a normal amount of affection appears to be as necessary as are any of the other factors in the environment which produce a sense of security.

Love, as we have already stated, changes both as to its object and as to the actual elements involved. It may be listed in a series involving diminishing intensity of physiological changes and increase in the ideational elements involved, as follows: love (in varying degrees), liking, comfort in the presence of, desire to approach.

With increasing age fear tends to acquire more ideational content and to occur with less violent physiological changes. As this ideational content increases, the emotion itself changes its character. Awe and reverence are both manifestations of fear, as witness the withdrawal reactions that always accompany both. A picture indicating reverence always shows a group displaying this emotion separated by some distance from the objects with they revere. This is also true of awe.

The following is a list of the manifestations of fear in order of diminishing intensity of physical changes: fear, anxiety, worry, insecurity (in the usual sense of the term), tendency to withdraw from, awe, reverence.

Anger, like fear, changes with increasing age by the addition of increased amounts of ideational material

accompanied by diminished physiological reaction. A list of the responses involved in anger, again in the order of diminishing intensity, is probably as follows: temper tantrums, anger, hate, irritation, dislike, criticism, mild verbal attack.

A brief analysis of the elements involved in all three emotions appears to indicate that there were originally only two, fear involving withdrawal and love involving approach. Somewhere in the process of evolution anger appears to have been added, without any change in its physiological concomitants, for the only difference between fear and anger appears to be in the set of the skeletal muscles. In the one there is always withdrawal by some means; in the other there is always a desire to approach and attack. No attempt is made to present here the infinite number of discussions as to whether there are three emotions or a single emotion for every type of experience. Such a classification of emotion as that given by Warren (14) is excellent if the reader wishes to list every possible variation of basic emotional drive. It may be an over-simplification to use Watson's (15, 16) classification and state that there are only three emotions and that all other emotions are derived from these. In this interpretation all other forms of emotion develop out of the three primary emotions as a result of conditioning. Actually for the most part they involve ideational content as well as the physiological responses present in the primary forms.

THE MILDER EMOTIONS

Pleasure. Pleasure is associated in the early period of the child's life with anything which makes for bodily comfort. It is probably merely a general feeling of well-being. Additional pleasurable responses, somewhat more intense

in character, appear to come from petting and stroking of the child, and the bath. Smiles may or may not be the direct accompaniment in both petting and stroking, after bathing, and during the period in which the child is lying in his crib resting. Gradually the smile (2, 3) comes to be associated with all types of pleasurable sensations and with the objects to which the pleasant sensations are traceable. The child begins to smile when adults who have been responsible for his comfort come into his range of vision, when food appears, and the like. From earliest infancy on, every attempt should be made to have the atmosphere which surrounds the child such as to suggest smiling and pleasurable responses in general.

Watson (15, 16) cites as the common causes of laughter the following:

1. Being played with (playfully dressed, tickled, etc.).
2. Running, chasing, romping with other children.
3. Playing with toys (a ball was particularly effective).
4. Teasing other children.
5. Watching other children at play.
6. Making attempts which result in adjustment (*e.g.*, getting parts of toys or apparatus to fit together or work).
7. Making sounds, more or less musical, at the piano, with a mouth organ, singing, pounding, etc.

It is interesting to note that when children are being dressed roughly, *i.e.*, by pushing or by pulling them about, anger is produced as a reaction. When they are being dressed playfully, on the other hand, they smile and laugh. Watson suggests that it is easy to overdo the tendency to amuse children when they are doing things they like to do, but the writer is of the opinion that, though this is a danger,

it is not so frequently met with as is that rougher method of handling children which produces anger states.

A list of the emotions present in adult life would include joy, grief, mirth, ecstasy, disgust, shame, envy, pride, and many other combinations of learned behavior and inherited pattern reactions. So complicated are the various emotional states and so great is their dependence upon learned reactions that it is often difficult if not impossible to determine the extent to which each element is present.

General emotional stability depends upon general visceral stability as regards external and internal stimulation, and this, in turn, depends upon the conditioning to which the organism has been subjected. The emotional life of individuals may differ widely both as to its complexity and as to the ease with which emotional states are aroused. Awe, reverence, sympathy, and similar complex emotional reactions may appear frequently in one individual and be difficult if not impossible to arouse in another. A slight stimulation may arouse great anger or fear in one individual while the other subjected to the same conditions remains calm.

Under modern conditions, the maintenance of normal emotional equilibrium and the ability to find socially desirable outlets for the emotions constitute important factors in successful adjustment. Much of the work of the mental hygiene clinics takes the form of finding normal outlets for, and reconditioning, unhealthy emotional states.

It is one of the primary functions of education so to condition the emotional life of children from infancy on that they will adjust normally in the social life of which they are a part.

EXERCISE

I. List and describe the situations which produced anger in your subject.

What methods appeared to be successful in dealing with anger states?

List and describe the defense mechanisms employed by your subject.

Does the child show affection? For whom and under what conditions? How is this affection expressed?

Does the child seem overdependent? Too independent?

Does he appear to have transferred affection from the home situation to any adult outside his home?

List and describe any reactions which appear to you to indicate normal or abnormal traits.

What causes crying?

What causes laughter?

II. Observe the behavior of a group of children of the same age as the case studied.

How many times did emotional disturbances occur? What were the apparent causes of these disturbances? What methods appeared to be adequate in dealing with them?

Do the same suggestions and situations call out the same emotional reactions at all times? What appeared to influence these reactions?

If it is impossible to observe a group of children, study the behavior of at least one child of the same age as the subject.

If this study is to be carried out over a long period, note any change in the stimuli which produce emotional states and in the number of times that emotional disturbances occur.

Compare the behavior of the child studied with that of other children of the same age.

Does your subject appear to have emotional control greater than average? Less? Average?

Bibliography

1. Blatz, W. E.: "The Physiological Appetites," in Carl Murchison, editor, "A Handbook of Child Psychology," 2d rev. ed., Chap. XVIII, Clark University Press, Worcester, 1933.

2. Blatz, W. E., K. D. Allin, and D. A. Millichamp: "A Study of Laughter in the Nursery School Child," University of Toronto Press, Toronto, 1936.

3. Blatz, W. E., E. A. Bott, and D. A. Millichamp: "The Development of Emotion in the Infant," *Child Development Series*, No. 4, University Toronto Press, Toronto, 1935.

4. Blatz, W. E., S. N. F. Chant, and M. D. Salter: "Emotional Episodes in the Child of School Age," *Child Development Series*, No. 9, University Toronto Press, Toronto, 1937.

5. Cannon, Walter B.: "Bodily Changes in Pain, Hunger, Fear and Rage," Chaps. I–II, D. Appleton-Century Company, Inc., New York, 1929.

6. Carr, H. E.: "Psychology: A Study of Mental Activity," Longmans, Green and Company, New York, 1925.

7. Cleveland, Elizabeth: "Training the Toddler," Part IV, J. B. Lippincott Company, Philadelphia.

8. Fenton, Jessie C.: "A Practical Psychology of Babyhood," Chaps. X, XI, Houghton Mifflin Company, Boston, 1925.

9. Frederiksen, Norman: "The Effects of Frustration on Negativistic Behavior of Young Children," *Journal of Genetic Psychology*, **61** (II): 203–226, 1942.

10. Groves, Ernest R.: "Personality and Social Adjustment," Longmans, Green and Company, New York, 1924.

11. Rasmussen, Vilhelm: "Child Psychology," Vol. I, Chaps. VIII and XIV, Alfred A. Knopf, New York, 1923.

12. Seashore, Harold G., and Alex Bavelas: "A Study of Frustration in Children," *Journal of Genetic Psychology*, **61** (II): 279–314, 1942.

13. Stern, William: "The Psychology of Early Childhood," Chaps. XXXV, XXXVI, Henry Holt and Company, Inc., New York, 1924.

14. Warren, H. E.: "Elements of Human Psychology," Chap. IX, Houghton Mifflin Company, Boston, 1919.

15. Watson, J. B.: "Behaviorism," Lectures-in-Print, Lectures VII and VIII, W. W. Norton & Company, Inc., New York, 1930.

16. Watson, J. B.: "Psychology from the Standpoint of a Behaviorist," Chap. VI, J. B. Lippincott Company, Philadelphia, 1919.

17. Woolley, Helen T.: "Overcoming Contrariness and Fears in Children," *Hygeia*, March, 1924, p. 164.

HABIT FORMATION

FROM EARLIEST INFANCY INNATE ACTIVITIES AND TENDencies to activity are being modified by the infant's reactions to the stimuli with which it is constantly surrounded. In every situation which presents itself some reflex and random activities are selected and form the basis for habits, while others cease to function in this situation but may become habitual responses in another. This process of forming habits goes on with such rapidity that by the time the infant is one year of age it is difficult, if not impossible, to separate the learned from the unlearned elements in the child's responses to even the simplest situations. Blanton* and others tell us that the feeding habits of the young infant may be modified by nervousness in the mother. Martin (28) gives definite evidence of a transferred fear state in an infant nine months of age. It is common knowledge that an avoiding reaction toward some individuals and a reaching toward others may be set up in the first six months. These and many other illustrations of the fact that emotional states and other types of reaction may be attached to persons and objects to which these reactions were not attached at birth and that reactions present at birth may be inhibited indicate

* BLANTON, SMILEY, and MARGARET BLANTON, "Child Guidance," D. Appleton-Century Company, Inc., New York, 1927.

the degree to which modification of innate tendencies may occur during the first year of life.

The infant is constantly selecting some responses to be perpetuated and others to be eliminated. Activities called out frequently because the stimuli to them are present and activities which result in increased satisfaction for the infant, or in the cessation of discomfort, tend to become habitual. Activities or tendencies to activity which do not receive stimuli adequate to call them out or which when called out produce lessened comfort or actual discomfort or activities for which more satisfactory outlets are found tend to drop out.

To summarize, innate activities and tendencies to activity and later acquired activities may be modified by practice or use and by the satisfactory or pleasant results of these activities. These two factors tend to make activities become habitual. Innate activities and tendencies to activity, and later acquired activities, may be modified by disuse, by unpleasant results,* and by substitution or sublimation. These three modifiers of activity tend to cause an act to drop out or to be inhibited. A further discussion of the means of modifying both innate and acquired activities and tendencies to activity follows.

Modification by Use. Many of the reflex activities with which children are born can be performed more rapidly and more accurately after they have been repeated a number of times, provided the effects obtained by the repetition of the act have not been unpleasant. In all learning, the more frequently an act or a series of acts has

* Occasionally unpleasant results, if very extreme, actually serve to fixate a response. This fact should be kept in mind in all situations in which punishment is involved.

been performed, the greater the ease of the performance and the less the degree to which conscious action is required. A further discussion of the modification of inherited activities and tendencies to activity by use will be found in this chapter in the section on the law of frequency.

Modification by Disuse. Inherited tendencies may be modified by the fact that no stimulus is presented which brings them into play. For example, the tendency to overcome obstacles may function little, if at all, if during the whole preschool period all obstacles are overcome for a child by some over-solicitous adult or older child. A child who is beginning to form the habit of taking books out of the bookcase may have another activity substituted for this undesirable one, or it may, because the bookcase is kept locked at all times, stop this activity entirely. In the latter case the activity would drop out through disuse.

A child who has had an experience with a poorly cooked vegetable may forget this experience if the vegetable is served for a long period in a manner wholly different from the one in which it was served when it was poorly cooked or badly seasoned. The tendency to avoid this vegetable may be said to have dropped out because the situation in which avoidance or withdrawal would be practiced and become habitual has not been presented.

The principle of disuse may be seen in a somewhat narrower application in the behavior of young chicks raised under laboratory conditions. Though the tendency to follow the hen appears in such chicks if they are placed with a hen during the first few days after hatching, it does not appear to function if the chicks are not returned to a chick run until after several weeks have elapsed.

There are probably many tendencies to attributes of personality inherited from parents, grandparents, great-grandparents, and ancestors even farther removed which do not develop because conditions are such that they never receive stimuli adequate to make them appear.

There are many instances in which disuse results in breaking down habits once initiated, whether these be good or bad. A child who has developed the habit of using the table utensils to feed himself may allow the habitual coordinations involved in this activity to deteriorate if he is placed in an environment in which he is fed. The habit may have to be reacquired almost in its entirety when he returns home. Children who have learned to walk and then receive injuries which result in confining them to bed over a period of months often need long practice before they walk with the facility with which this act was performed before the injuries. Common instances of the deterioration of a habit through disuse are found in the loss of skill in golf, tennis, and other outdoor games, when practice has not been kept up.

Occasionally a rest period actually produces an apparent improvement in the speed and accuracy with which an act is performed. Book (2), Swift (34), and others suggest that usually where there has been an apparent increase in skill after a rest period, the apparent improvement is due (*a*) to the fact that fatigue masked the real improvement in the last practice periods preceding the rest, or (*b*) to the fact that, because of fatigue, emotional stress, loss of interest, or some other factor which produced lessened zeal and attention during practice periods, errors have crept in and these have been repeated along with the correct movements. These erroneous or irrelevant move-

ments have received less practice than have the correct ones, and therefore tend to drop out relatively rapidly. The elimination of the wrong or irrelevant movements results in an added facility in the operation of the habit. In the same way, irrelevant movements, not introduced by fatigue or by any of the other factors discussed, but coming up by the law of chance a certain number of times during a series of practice periods, may drop out during a period in which there is no practice, while the correct movements, having a higher degree of permanence because they have been exercised more frequently, persist. This topic will be discussed further in connection with the law of frequency.

Modification by Satisfactory or Pleasant Results. Pleasant results and a state of satisfaction are used here in much the same sense in which satisfaction is used by Thorndike, *viz.*, that a pleasant or satisfactory result is obtained when the condition of the organism is such that the child does nothing to change it, when the condition is such that he is content to remain in it for the time being. The condition may be highly pleasurable, in which case there appears to be evidence that the activities which led up to this condition will tend to be perpetuated for a longer period than where a milder degree of pleasure accompanied them. A child who finds that crying results in added attention, bribes, or rewards, or in the assurance that he does not need to do things which he wishes to leave undone, may be said to have had satisfaction result from crying. This tends to set up a habit of crying or of having temper tantrums such as were discussed in the chapter on the emotions. A feared object which has had associated with it withdrawing reactions may, by being associated with pleasant results,

have substituted for the withdrawing reactions a habit of approaching and manipulating the object.

Modification by Unpleasant Results. Any activity which has as its result lessened satisfaction, or the production of discomfort or of pain, will tend to be inhibited. Crying which produces no result, or actual discomfort, tends to drop out as a form of response, except under conditions of pain, illness, extreme discomfort, and the like. Rough play and shouting from a comparative stranger may be so unpleasant to a young child that a habit of running away and hiding from such a person may be set up by a very few experiences. The sight of this person may come to produce the withdrawing reactions at once.

Good habits of eating and other desirable activities may be associated with a scolding person and, therefore, acquired with difficulty and discarded as soon as possible. Many persons, in training children, associate unpleasant results with the very activities which they are most desirous of establishing as habits and thus defeat their own attempts to set these up. The most frequent illustration of the attachment of unpleasant results to undesirable activities occurs in the field of punishment. Punishment always resolves itself into an attempt on the part of someone to attach unpleasant results to undesirable activities. When the punishment is the direct outgrowth of the act itself, it serves as a much more educative deterrent than hand slapping or some other hit-or-miss form of unpleasant result.

A young child who has torn up paper all over the floor and who has to pick it all up before he can start some other activity is much less likely to repeat the paper tearing than

the same baby would be if the punishment had been a sharp slap.

If too much excitement surrounds punishment for a simple offense, a child may repeat the offense for the sake of the excitement, in spite of the punishment.

One has to take into consideration, too, the later effects of hit-or-miss punishment. One may, by injudicious attaching of unpleasant results to activities undesirable in part, inhibit acts which in themselves contain desirable elements. A child punished severely for marking on the walls of the nursery may be inhibited in his later interest in drawing unless at the same time he is told that "marking on sheets of paper is all right because he can put the sheets of paper away, and drawing on the blackboard is good because we can rub that out, but drawing on the wall of the room makes ugly marks which we must look at until we get new paint." It is also wise to determine, when possible, what natural interest prompted the activity which we are checking, since in many instances it probably came out of some felt need on the part of the child which can be met. One baby, when reproved for marking with colored chalk on the nursery walls, complained, "But I want pictures." A frieze of colored animals served to satisfy his expressed need and to amuse him for endless hours. A second child who would rummage in drawers in spite of punishment stopped his practice when given a small chest of drawers of his own.

The more substitutes that can be found for undesirable activities, the less unpleasant results in the form of punishments will be found to be necessary. Other things being equal, the nearer the unpleasant results attached to un-

desirable activity can be made to approximate the natural outcome of the act itself, the less frequently will the act itself tend to be repeated.

Modification of inherited tendencies by substitution or sublimation follows the lines of procedure common in good modern educational practice. Substitution or sublimation means merely providing an outlet for activities or emotions which were originally undesirable along lines that will be valuable to the child. For example, the tendency of a baby to pinch or slap may be changed, if each time the child's hand touches the parent's cheek the hand is opened by the parent and the stroking movement made. A baby who would pick up and eat paper from the carpet was given a tiny wastebasket and trained to put the paper in the basket. When she had picked up and placed in the basket two or three pieces, she and her mother made a ceremony of emptying these out of doors. Putting the paper in the wastebasket proved to be an excellent substitute for putting the paper in her mouth.*

The whole trend of modern civilization is toward the sublimation of those activities which come out of the uninhited expression of the primary emotions. If adequate outlets can be found many conflicts and much use of escape mechanisms can be avoided. The tendency to strike when angry may be sublimated and the emotion find its outlet in some other and more desirable form of activity. In the preschool period the activities coming out of the emotion of anger may be directed toward taking care of

* This substituted activity, as is often the case, had to be watched. The baby put any objects found on the floor in the basket, but, since this was a far safer activity than her earlier one of putting things into her mouth, the substitution could be considered satisfactory.

and fighting for weaker and younger children. In adolescence and adulthood these activities may be directed into fighting to change the political party in power or to bring about a change in social conditions or toward some other end equally far removed from the original tendency to response.

Anger in the adult often finds its outlet in that peculiar exercise of the imagination in which the individual pictures himself in the situation in which he was made angry and then proceeds to make, to the person who aroused the emotion, the series of brilliant responses of which he could not think at the time at which the incident occurred. Life under civilized conditions gives constant training in sublimating the activities connected with the emotions.

Fenton (9) gives two excellent illustrations of the use of substitutions for undesirable activities where mere repression had failed to cause those activities to drop out.

A little boy, not yet two years old, had discovered how to manipulate the stopcocks which served to turn on the gas in the gas stove, and persisted in running to turn them all on whenever he came into the kitchen. Manifestly this must be stopped, and at once, lest he asphyxiate himself some day before anyone should discover his plight. His mother argued with him earnestly and at length, explaining that it would hurt him if he turned the little knobs, and forbidding him with great solemnity and emphasis to touch them. This, however, had only the effect of enhancing his curiosity and interest. In desperation his mother slapped his hands (tactics which she had hitherto not used with him), but this only made matters worse. The baby became extremely excited, and ran again and again to turn all the gas burners, crying hysterically all the while and watching his mother with a terrified face. He behaved almost as if hypnotized by the irresistible fascination of those shiny little knobs. Seeing that matters had only been made worse, his mother soothed the little fellow, and led him to the stove. Then she showed him the elbow where the gas pipe turned at the corner of the stove, and said, "See this

nice shiny little corner? You may touch the stove right here. Here" indicating the forbidden stopcock "is where Mother may touch the stove. Now show me the place where you may touch it." The child proudly laid his hand on the elbow of pipe, saying, "This Bobby's place." "And where may Mother touch?" "That Mother's place," said the baby. "Yes, dear, that's fine! Now you touch your place. Yes, that's right. That is Mother's good boy!" Later when the father came home, the mother suggested to the baby that he show Father the nice new place where he might touch the stove, which he accordingly did, with evident pride and satisfaction. This particular problem now proved to be solved, for the baby showed no further desire to handle the stopcocks, except occasionally to point to them with the remark, "That Mother's place."

Sometimes a compromise may profitably be effected, when it proves impossible entirely to divert a child's attention from something that he must not do. My baby had discovered that he could climb on a chair and get matches from the match box, and found these "little 'ticks" most charming playthings. I tried to make him forget them by offering other toys whenever he got hold of a match, but he could not be induced to forget them, and command and entreaty proved unavailing. So I took a match, pointed out the head end and explained that it would hurt him, then broke off the head, and gave him the stick, saying "There, Mother will fix it for you. Now you may have the little stick." Then I handed him a second match and said, "Now bring it to Mother. Mother will fix it for you." I had him practice by bringing me two or three more matches, which I "fixed" and returned to him, and impressed it upon him that whenever he found a match he was to bring it to Mother and let her fix it before he played with it. This arrangement satisfied him perfectly, and henceforth when he found a match, or was moved to climb up and get one from the box, he would run through the house until he found me, crying, "Fits it, Mother, fits it!" and then go happily about his play with the "little 'tick."

Modification by substitution or sublimation is a much more difficult form of control to exercise than is repression. Great ingenuity is often required to find an adequate outlet for a tendency which is functioning in the wrong way. It is far easier to punish a wrong act than it is to find for

such an act a substitute in which the child will be interested and which will have valuable results for him, but the control exercised in this way is both more educative and more lasting in its effects. Constant repression tends to develop many of the most undesirable traits of personality.

Activities which are perpetuated through exercise and through the satisfactory results which follow such exercise are termed habits. One may also acquire the habit of disregarding certain types of stimuli and of inhibiting responses to yet other types. For example, the tendency to reach for bright objects may be inhibited as regards burning a candle by the fact that the child has received a burn from the flame. The inhibition of this reaction may be said to be a habit.

All modifications of innate activities and tendencies to activity result in the formation of habits of acting in one way in the presence of specific stimuli rather than in any of the other ways in which the innate equipment of the infant permits him to act. Unpleasant results cause an act to be inhibited or to find other outlets. Absence of stimuli adequate to cause innate tendencies to function as activities results in the dropping out of these tendencies.

Three laws are operative in all types of learning from the most simple to the most complex. These are recency, frequency, and intensity.

The Law of Frequency. This law, sometimes called the law of use, refers to a basic principle in memory. It means simply that the more times a response has occurred to a stimulus, the stronger the connection between the stimulus and the response. The more frequently the parts of a complex activity are performed together, the greater the

strength of the connections between them. Strengthening the connections or bonds between the series of activities involved results in greater accuracy in the performance of the act as a whole.

The Law of Recency. Other things being equal, the more recently an act has been performed, the more readily is it called out and the easier is its performance. (See Law of Disuse.)

The Law of Intensity. Other things being equal, the greater the intensity of the experience, the more rapidly are connections made between stimulus and response, or between a series of responses involved in the performance of a complex activity. Intensity may be a matter of the actual intensity of the stimulus itself, *e.g.*, the loudness of a sound, the brightness of a color, or the intensity of the pain sensation to which the response is made. A baby who has been severely burned when he reached out and touched a flame may inhibit the act from that time on. The intensity may be in terms of satisfaction or of unpleasantness attached to the response. In one case the connections would be strengthened, in the other weakened or broken up altogether. The degree of satisfaction or of unpleasantness is sometimes the product of an emotional tone peculiar to one individual alone. Physical conditions, the degree of fatigue, inherited predispositions, satisfactions derived from previous experiences, any type of predisposition peculiar to an individual child, may make an experience intense for him, where the same experience may have little intensity for other children of his age. For this reason, a response may be more easily learned or more readily inhibited by him than by other children placed in the same situation.

The learning process proceeds at a rate proportionate to the ease with which satisfaction is attached to correct responses and unpleasantness to those which are irrelevant or incorrect. Certain activities, like handwriting, are illustrative of just this point. It is difficult for a child to discriminate between sensations received from erroneous and those received from correct movements. Learning to write, therefore, requires far more practice than does an activity in which satisfaction can be attached to the correct result with relative ease. In many instances one must rely on the number of repetitions alone to perpetuate the correct movements. Many individuals practice months or even years with little apparent improvement, since erroneous movements are practiced as frequently as are the correct ones. Under these conditions, practice periods resolve themselves in part into practice in and perpetuation of errors.

Both the law of frequency and the law of intensity are often disregarded in child training. If a child is allowed to make today an undesirable response to a situation, and tomorrow forced to make the correct response, and this alternation of responses is kept up, the bonds between both of the responses and the stimulus situation are exercised and both are, therefore, strengthened. If, in addition, the response not desired by the parent is more pleasant to the child than the desired one, the bond between this response and the stimulus tends to become the stronger. For example, if "You may not" always means that a child is really denied a permission, he comes to respond to that phrase by ceasing to make demands. If, on the contrary, "You may not" sometimes means a prohibition but at other times may be changed to "You may" by persuasion, crying, or other methods, prohibitions

merely tend to set up the crying, persuasion, or other responses which have been successful in changing prohibitions into permissions on previous occasions. Numerous other examples of the equal exercise of desirable and undesirable activities can be found in the education of children both at home and in school.

It is important to give ample opportunity for the performance of desirable activities and to see that these result in satisfaction. It is equally important to find substitutes for, or to make unpleasant, activities which should be inhibited.*

Curti (7) questions the whole concept of frequency as a factor in learning. She also questions whether the pleasant or unpleasant results of an activity have any relation to its inhibition or its perpetuation. She states that an activity may be performed any number of times without improvement and that such a hedonistic concept as that expressed by some authors in stating that a child will repeat an activity in which he finds satisfaction is outworn and disproved by such authors as Dunlap (8). In order to prove that frequency has no effect on learning, she states that to remove a child's thumb from his mouth every time he places it there does not cure him of the habit of sucking his thumb. In using this illustration she overlooks two important points: (*a*) the child is practicing thumb-sucking every time the thumb goes to his mouth, and (*b*) few results could be more unpleasant than thwarting him by removing his thumb against his will. The removal has definitely unpleasant results, while the thumb-sucking when the

* The most efficient method of eliminating undesirable activities is to find for them an outlet which produces a higher degree of satisfaction than the acts to be eliminated.

thumb was in his mouth was obviously satisfactory or he would not have returned the thumb to his mouth again and again, unless, of course, he had had it there so frequently that the act went off without any conscious control or reaction.

In a later chapter Curti (7) cites the case of a child who learned to attach the sound "dada" to his father. She states that when the sound "da" was made it produced no response, but the combined sound "dada" was accompanied by smiling on the part of both parents. After a period in which he used both "da" less frequently and "dada" more frequently, the latter each time accompanied by response from his parents and the former by no response, "dada" became his accepted way of greeting his father. A better illustration of the use of the principle of frequency accompanied by pleasant results resulting in the elimination of wrong responses and the perpetuation of right ones could hardly be selected.

Curti cites Dunlap's (8) work as nullifying both the principle of frequency and the effect of the results of an act upon its perpetuation. Dunlap refutes neither of these. When he forces his subjects to practice an activity which they have previously enjoyed in private both publicly and beyond the point at which they wish to discontinue the activity he has attached unpleasant consequences of two types: (*a*) the sense of achievement which may have accompanied the act performed in private has now been eliminated and in addition he is watched with disapproval by people whose respect he wishes to hold; and (*b*) he is forced to continue to the point of pain or exhaustion an act which could previously be terminated while it was still giving satisfaction.

The principle which Dunlap (8) advocates is one long in common use by educators who deal with young children. A child who is screaming in the house is often asked to go outside and scream until "he gets it all out of his system." Long after he wishes to stop he is told to keep on so he won't need to scream when he returns to the schoolroom. This shortly eliminates this bad habit. The application of this technique to thumb-sucking and masturbation is not new, nor does it invalidate any principle of learning which involves the concept that the results of an activity influence its retention. The results of its application in connection with thumb-sucking and masturbation may be highly detrimental.

Punishment for activities which it is necessary to eliminate is simply one form of attaching unpleasant results to undesirable activity. The punishment may take the form of severe discipline involving corporal punishment. It may merely mean that a child who has thrown blocks on the floor must pick them up before he can engage in other activity. It may mean only that an activity in which he engaged to cause excitement and to give himself the center of the stage is completely ignored. All of these, from the most severe punishment to complete failure to respond as expected, are unsatisfactory results.

Curti (7) also suggests that no one ever learns by mere repetition. She then cites the work of Burtt on retention. Sophocles was read aloud to a child fifteen months of age a number of times. When this material was later presented the child was able to memorize it much more easily than passages which had not been presented to him at fifteen months. Obviously the mere repetition of verses which no fifteen-months-old could possibly be motivated to acquire *had* resulted in learning.

The author takes the point of view that for the acquisition of all learned elements practice is necessary. Acts which are constantly accompanied by pain are eliminated, unless the pain is so violent as to produce a hypnotic effect and make the inhibition of the act impossible. Acts which give satisfaction tend to be repeated.

The speed of learning is dependent upon the degree of motivation, the general condition of the subject both physical and emotional, the general environment in which the stimulus is presented, and the plasticity of the learning subject. By this latter is meant both mental level and speed of learning, both ease of acquisition and degree of retention.

Learning, then, is dependent upon other factors than the stimulus and the responding subject, since the subject himself differs in his response when any of the factors above listed change.

It is important to give ample opportunity for the performance of desirable activities and to see that these result in satisfaction. It is equally important to find substitutes for or make unpleasant activity which should be inhibited.

Learning may be of six types:

1. The mere perpetuation of a reflex.

2. The conditioned reflex.

3. A simple act in response to a simple stimulus.

4. The integration of old habits into a new pattern, together with the learning of new activities as a part of this pattern. This learning is usually termed "trial and error" or "trial and success."

5. Perceptual learning. This involves the attachment of meaning to stimuli. "A series of elements not previously related forms a new pattern with its various meanings attached. Further practice with the new pattern and its meanings may add new elements with their concomitant meanings or may eliminate certain of the elements that occurred in the original pattern. In any learning situation one or both of these learning reactions may occur; in fact they frequently do. A child who has learned the letters which spell Sally may learn them in the peculiar position of S on top, A before the S, the two L's at different corners of the paper, and the Y in a horizontal position. Further practice with these visual elements in their correct pattern will suddenly produce all of the letters in proper sequence. The whole pattern has now been learned as it will later be produced. Had the child also learned a W in connection with the Sally, practice should have eliminated the irrelevant element before the pattern was integrated.

6. Memorization. On this is involved not only the additional activity of memorization but also sensorimotor learning and perceptual learning.

7. Logical thinking or reasoning, in which all of learning is involved except overt activity in response to stimuli.

The Mere Perpetuation of Reflex. It is a well-known fact that all reflexes when they just occur are less perfect than they will be when fully developed after months or years of practice. Mass activity is characteristic of all reflex reactions,* even such specific reactions as blinking. Response to a touch on the cornea does not always appear nor does

* Irwin, O. C., and A. P. Weiss; "A Note on Mass Activity in Newborn Infants," *Journal of Genetic Psychology*, **38**: 20–30, 1930.

the sucking reflex when stimulation is present. Nor do they function with equal rapidity and occur at all times. In addition to blinking, the child is apt to move his hands quickly, wave his feet, contract parts of the body, make facial grimaces, and sometimes stimulate the vocal chords to crying or mewing. Glandular reactions are also present. In a word, the reflex blinking occurs not always but often with a mass of other and frequently irrelevant activities, most of which can never be of value in reacting to the stimulus. Sucking may not occur until children are aided. It rarely occurs after a full meal. When it does occur in response to stimulation of the mouth area, it too is accompanied by mass activity, much of which is later eliminated. This is true of all reflex responses, in animals as well as infants. The chick pecks within the first three hours of birth, but his reactions to cracked corn and other foods are anything but accurate. A learning curve can be charted in terms of the number of successful pecks in an hour in each of ten successive days after birth. Some degree of learning is present in connection with all responses to stimuli. This learning may be evidenced by more rapid and more accurate response and also by the elimination of irrelevant activity.

The Conditioned Reflex. While some psychologists would be willing to endow Pavlov's (31) dogs permanently if further reference to them might be avoided, it is nevertheless from these experiments that the concept of the conditioned reflex arose. Until these experiments were published, the concept of conditioning did not appear as an explanation of behavior.

It is not necessary now, however, to use dogs or any other type of animal to see the attachment and detach-

ment of reflex responses. A few illustrations will serve to prove our point. The blinking reflex, which is originally attached to a touch on the cornea, by a series of experiments within the laboratories or in daily life becomes attached to any object approaching the eye. In fact it may become attached to motion far distant from the subject, *e.g.*, a gesture which indicates that an object may be thrown which *may in time* reach the eye. As a class experiment the author frequently picks up some small object and makes the gesture of throwing. In a class of 100 students over 75 per cent will agree that they have made some withdrawal motion and blinked. A reflex response originally attached to a touch on the cornea was now functioning in a situation remote from its earlier attachment. The description of a picture of a cake which appears in an advertisement in a magazine not even in the classroom will immediately cause salivary secretions. In many cases these secretions are sufficient to necessitate repeated swallowing to get rid of the saliva. It is sometimes necessary to stop them by further conditioning. It is suggested that the class is sucking very sour lemons or that each member is about to be called upon to make a speech. The secretions shortly stop and the mouth becomes dry—a further example of the everyday operation of the conditioning process.

Such instances of conditioning are too frequent to mention. It should be also remembered that even the endocrine glands are functioning in this fashion. The thyroid gland may be stimulated to a high degree of activity by visual stimulation.

The presence of conditioned reflexes in young children has been clearly demonstrated by Marquis (27) in con-

nection with sucking and mouth-opening responses, by Kantrow (22) also in the attachment of sucking movements and their detachment, by Wenger (39) using tactual stimuli by Kasatkin and Levikova (23) in connection with auditory stimuli.

Conditioned reflexes are not always attached as a whole. Instead of withdrawal the animal or infant may step to one side or use some other means of avoiding the stimulus. In Warner's (38) experiments rats which had responded with a quick jump when first shocked while a buzzer sounded later developed a slow jump in response to the same sound. Some merely learned to brace themselves. Individuals who originally blinked when a buzzer sounded later moved their heads.

The conditioning of reflexes is possible at birth and perhaps in intrauterine life.

There is probably no time from birth to death when the individual is not being conditioned in one way rather than another. That many of these conditionings go on without conscious control is evident from the work of Cason (5), Hudgins (17), and Twitmyer.* Twitmyer's subjects report that their knees gave a reflex jerk when the bell sounded "as if against their will." Cason succeeded in attaching the pupillary reflex to sound.

In every learning situation, no matter how far it appears to be a matter of pure memory or logical thinking, conditioned reflexes also play their part. Nausea may occur whenever problems in geometry are being solved. The sight

* Twitmyer, E. B., "A Study of the Knee Jerk," University of Pennsylvania Ph. D. thesis, 1902, reported by Cason in "The Conditioned Reflex . . . as a Common Activity of Living Organisms," *Psychological Bulletin*, **22**: 445–472, 1925.

of a chemistry textbook may produce a rapid heart and an increase in the rate of breathing.

That these conditioned reflexes play a large part in learning has been overlooked in the planning of curricula. So important are these conditioned reflexes in all types of behavior that they may overshadow them and affect the most skilled presentation of subject matter.

A Simple Act in Response to a Simple Stimulus. A large number of situations in which learning occurs are of this type. The infant reaches when his mother approaches the crib. The elements involved are a recognition of the mother's voice or general shape plus the activity involved in sticking out the arms. Reaching is a complex activity and learned slowly, but once it is learned it can be attached as a single set of activities to any simple stimulation: to bring objects, to nurse and parents, to the approach of food, to toys, and to animals. Once the complex eye-hand coordination and the muscular activity are integrated as a pattern they may then be attached as a whole to any stimulus.

Such verbal reactions as saying "Good morning" or "Hi" when one reaches nursery school, picking up a coat and hanging it in the locker, opening books, standing up at the sound of a certain type of music, climbing into a crib when told "It is time to rest now" are all illustrations of simple learning situations, always provided that the muscular activities involved in them are learned previous to the time at which the situation occurs.

This learning frequently deceives individuals who are in charge of the learning activity of young children. Because simple learning habits are learned rapidly, children are expected to learn the reactions to complex situations

equally rapidly. We are told by many uninitiated individuals that young children learn very fast. Thorndike (37) and others have indicated that the opposite is the case. A major proportion of the activities in a nursery school or at home may be classified under the head of simple responses or already learned responses now attached to simple stimuli.

As an illustration of learning which involves a complex activity, let us take learning to eat. The parent seats the eighteen-months-old child at a table and hands it a spoon. The child has already learned to grasp; in fact that was a reflex response. Eye-hand coordinations are present to some degree, though not in connection with feeding himself. The child has already learned some coordinations of the fingers and of the arms and shoulder. Body balance which enables him to sit erect has been a part of his behavior since he was six months old if he is an average child. Chewing and swallowing are also among his activities. What is necessary to master this particular learning situation is the elimination of unnecessary activities while he at the same time integrates the essential ones. When the spoon is placed in his hand mass activity occurs. Immediately the child bounces up and down; he may shake his head "Yes" or "No" or turn his head in any possible direction. He kicks the chair with his feet and knocks the table with his elbow, bangs with his spoon. In addition he may push the table, pull his tablecloth, upset his plate. In a word, mass activity is present wherever integrated pattern activity is more or less absent. In order to see the food, dip in his spoon, and bring the food to his mouth without spilling it over himself, the table, and the surrounding floor, the child must inhibit the major part of

his mass activity and develop a pattern which in the presence of food results in some such sequence as the following: see the food, dip in the spoon, bring the spoon to the mouth, use lips, tongue, and hand to bring the food into the mouth, then chew and swallow it. Here the laws of chance and the attachment of pleasant results to some activity and unpleasant ones to some others will in time result in a more or less successful adaptation.

If then the correct motions result in getting the food to the mouth with pleasant results (we hope) and wrong motions made result in no food when the spoon reaches the mouth, the right movement will be perpetuated and the wrong will tend to be eliminated. The parent also makes unpleasant certain activities by scolding, hand taps, or some other means. Only long practice involving the operation of the law of chance will perfect this habit pattern so that the motions involved in it will be largely relevant and the earlier irrelevant motions will be eliminated. Relevant movements must appear every time the activity is practiced. According to the laws of chance, each of the other movements has only a fifty-fifty chance to appear on the average. This means that some will occur 25 per cent of the time and others 75. Some may occur only once or twice. Those that occur least frequently tend to be eliminated first; those that occur most frequently tend to be eliminated last. If an irrelevant movement does occur as often as do the correct ones, it is apt to be perpetuated as part of the habit. If then correct movements tend to come up at the end of the practice they are then more recent to the beginning of the next and will tend to appear early in the next practice. The laws of recency, frequency, and intensity—the last in terms of satisfactory and unsatis-

factory results—have operated to further the learning of the habit of eating.

Such reactions as kicking the rungs of the chair, eating with the mouth much too full to chew, bouncing up and down at table, and pounding with one hand while one eats with the other are illustrations of the perpetuation of the wrong movements along with correct ones. There are many adults who find it necessary to tangle their feet in the rungs of the dining-room chair while eating, a direct perpetuation of infantile irrelevant movement.

Even a superficial survey of learning by the trial-and-error method, as discussed above, will show both the ex-

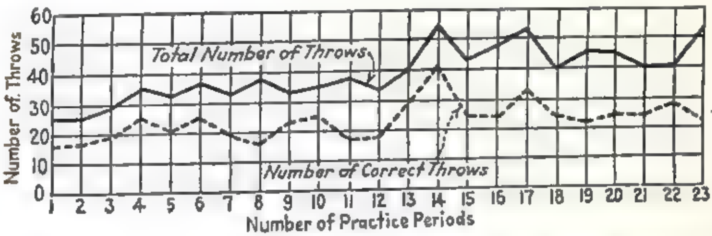


FIG. 11.—Graph showing improvement in learning to throw beads into a basket (33).

treme effort necessary and the enormous amount of practice which must go on in order to select out and fuse together into a habit even a few simple activities.

Many curves of trial-and-error learning in the acquisition of skills appear to have three clearly observable characteristics: (*a*) an early period of rapid improvement, often followed by (*b*) a period of no improvement or of retrogression, and (*c*) a general appearance of irregularity; *i.e.*, learning does not proceed at a uniform rate. The first of these characteristics does not appear in the learning

curves presented herewith. The problem presented by the experiment in which these curves were obtained was to increase skill in throwing round wooden beads into a basket. The subjects were two nursery-school children aged respectively three years and eight months and three years and nine months. The beads used were 1 inch in diameter. The children stood 2 feet from the basket and threw in the beads as rapidly as possible. Increase in skill was measured by (*a*) the number of beads thrown during the practice period and (*b*) the number of correct throws. The period of rapid progress during the initial stages of learning does not appear in either of these curves, nor does it appear in the curves of the other three- and four-year-olds used in our experiment.

The period of rapid progress in the learning curves of more mature subjects has been explained in various ways. It may be due to the fact that the elements first mastered constitute the easiest part of the habit and are, therefore, learned more quickly. It may be due to the fact that there is a greater interest in the material when it is new, and learning proceeds at a rapid rate because of the great concentration and the great amount of effort expended. It may be due, as Book (2) states, to the fact that the opportunity for progress in the early stages of learning is greater than in any other stage. It may be due to the fact that identical elements which have been learned in other situations are brought into play in the first stages of learning. The fact that a period of rapid progress did not occur with our subjects may be due to the fact that at three one has acquired few motor skills which can be brought into play when a new habit is being mastered, or it may have been due to some other factor or factors.

One factor which may have been operative in producing our results is a difference in the "felt need." The children were interested in the activity itself. We were interested in having them develop skill in throwing beads into a basket. They improved in number thrown more than in the accuracy with which they threw.

A felt need is essential for the mastery of all complex habits. Unless the subject feels that mastery is essential to the furtherance of his desires or needs, he learns not the problem which is presented but a habit which will fill a need which he does feel.

This habit may be directly opposite to what one wishes him to learn. Students who take required courses do not master the subject matter presented thoroughly. On the contrary, they frequently learn to take notes without paying the least attention to the subject matter, while at the same time they think of something which is of interest to them, such as a trip to a shop or an interesting date.

Instead of mastering chemistry or biology, they learn to sit on the edge of their chairs with an expression of absorbed interest while at the same time they think of a more interesting subject.

One of the writer's students confessed that she had planned her entire winter wardrobe while she took notes in a required course.

A boy of nine who had appeared most interested in geography was later found to have been making up new adventures for Superman. When he failed on an examination the teacher had been so convinced by his expression of interest that she said that he was "a child who did not do well under the strain of exams."

In parent-child relationships this all too often is the cause of parental strain and infant disobedience. The parent wishes the child to learn to dress himself as rapidly and accurately as possible, while the child's interest and therefore his learning is concentrated on finding out the greatest possible number of delays in order to compel the parent to finish the dressing process for him.

The felt need may be immediate or it may be distant. For young children it must be immediate.

It may be immediate or it may be derived. The felt need may be to master the process of eating, or it may be to avoid a spanking which follows a failure to eat properly. Whatever the situation the absence of a felt need produces interference with learning, if not completely inhibiting it. The absence of the felt need may produce a plateau or such blocking that the activity is never mastered. In relatively simple habits such as the ones acquired in our experiment, this plateau may not appear, but in the acquisition of complex activities it is nearly always present. The plateau may be due to some physical condition, as, for example, illness, which causes the attention to be directed to the condition of the individual rather than to the material to be learned. Strong emotional states which have much the same effect in producing divided attention as does illness; loss of interest, which may be due to a number of causes, including the inability of the learner to measure his own progress in any way; and a change in methods of work, which breaks certain of the habits established under the earlier methods of attacking a problem, also produce plateaus. Finally, the cause for the plateau may be inherent in the type of material which is being mastered. Where the new skill requires a mastery of a

number of simple habits before the habit as a whole can function, the plateau may be in the nature of a rest period during which the simple habits are being brought to the point of perfection. When this point has been reached, the learner leaves the plateau period with a sudden burst of improvement. This is the explanation which is given by Bryan and Harter (3) for the plateaus found in the curve for learning telegraphy.

A shift in interest may also cause this plateau. A child who has been learning to walk may show a plateau period in this learning when his attention shifts to language. Language during this shift may show rapid progress. When a shift back to walking occurs, a plateau period may appear in the learning curve for language and a period of rapid progress appear in the learning curve for walking.

Irregularities (short-time fluctuations) in the curve may be produced by a number of the factors cited above as responsible for plateaus. Emotional disturbances, slight illness, distracting of attention by outside noises, and the like are responsible for many of the irregularities in the curves presented herewith. They may also be produced by the fact that, at any stage in the learning, a new error may creep in. Such an error may serve to throw the habit off for the time being, producing, as a result, a rise in the curves for both time and errors. Learning of the trial-and-error type may be shortened appreciably by an adult who selects for reward or who calls attention to that part of the activity which is correct, *e.g.*, in feeding, placing the spoon and fork in the correct position in the child's hand. Learning proceeds slowly in proportion to the ease with which satisfaction is attached to correct responses. Where the adult definitely selects the correct responses

and attaches satisfaction to them, the learning time is much diminished.

Too few studies have been made to date of the learning curves of babies and children of nursery-school age, even for the simplest functions, to draw any definite conclusions where complex activities are involved, but it is probable that the learning curves of young children approximate the form of the curves for learning complex habits presented by Bryan and Harter and others and are influenced by the factors given above. Plateau periods in such a complex activity as the mastery of language may frequently be observed. The baby may stay in the period of the one-word sentence for a number of months, and then suddenly leave the plateau and begin to speak sentences containing a number of words.

The whole first year of the infant's life, exclusive of time spent in eating and sleeping, is spent in the acquisition of control over movements by this more or less haphazard process of selection. Where the stimuli are few in number and the child is left to himself almost wholly, the probabilities are that the series of activities over which control has been gained will be remarkably few in number. On the other hand, such devices as a colored ball with bells hanging on the baby carriage some distance in front of the baby does give additional practice in the acquisition of control over the eye muscles. Finger plays and plays which involve selecting movements of the hand and arm, by increasing the intensity, heightening the satisfaction attached to such movements, do result in increasing the rapidity with which control is gained. The average mother uses finger, hand, and arm plays with her baby, as, for

example, "Pat-a-cake" and "This little piggy went to market," more or less as a matter of course.

Mary Cover Jones, in her study "The Development of Early Behavior Patterns in Young Children," gives the days at which certain responses appear and certain habits are set up. Each of these habits requires practice and proceeds in its development in line with the laws of habit formation though most of this learning is at a low conscious level. The following are the times at which these early learned coordinations appeared in the group of 365 infants studied by Dr. Jones (21): horizontal eye coordination at 58 days; circular eye coordination at 78 days; and using the opposing thumb at 148 days.

Goodenough (13), Gutteridge (14), Jersild (20), Wellman (40), and Hicks (15) take the position that progress in trial-and-error learning in children is similar to that found in animal experimentation or learning processes at the same level and to that found in studies of adults where the material is similar in type and difficulty to that presented to the child. Gates and Taylor found curves of a trial-and-error type in preschool age learning of writing.

Trial-and-error learning is always characterized by (*a*) mass activity; (*b*) the need for long practice, concentration, and interest; (*c*) the elimination of wrong motions, sets, or attitudes; (*d*) rhythmic performance of right activity.

The standardized tests for children of preschool age give clear indication of the types of motor control which have been gained by the end of certain definite periods. According to the standards set by the Kuhlman tests (25), the infant, at the age of three months, should be able to

follow a light with his eyes and to turn his eyes to an object in the marginal field of vision, indicating that binocular coordination is fairly well developed at this time. At six months, the infant should be able to balance his head when held upright, and he should also be able to turn his head toward the source of sound, to use the opposing thumb in grasping, to hold an object in his hand over a period sufficiently long to indicate that his hold is not merely the result of the grasping reflex, and he should be able to reach for seen objects held in front of his eyes. By the end of twelve months, he should be able to sit up unsupported for two to three minutes or stand unsupported for five seconds, to vocalize spontaneously or to have control over such syllables as "ba," "dada," "nan," "papa," and "man," to imitate such simple movements as shaking the rattle, and to mark with a pencil under the conditions set by the Kuhlman tests.* As these are standardized tests, they indicate the performance that should be expected from the average child at these ages. It is obvious that by the end of the first twelve months of the child's life, he has selected out and gained control over a great number of movements by the process of trial-and-error learning, since all the movements involved in the tests in the Kuhlman revision of the Binet-Simon scale require a degree of control far in advance of that with which the infant is born.

* The absence of any one, or even of two or three such habits at each age should not be taken too seriously, inasmuch as each of these represents the performance of the average child. Some children will not have acquired control over one or two of the habits listed as acquired at year one and will have acquired a compensating number of habits listed under eighteen months or even two years. Diagnosis of mental retardation should be made only by a specialist. The lists are given merely to indicate the types of habits which the average child may have acquired by the end of each of the periods listed.

Terman and Merrill (35) have revised the Stanford revision of the Binet test to include standard performances for children from two to five years of age. The habits necessary for the performance of these tests range from simple motor activity, obedience to commands, and simple vocabulary, through the recognition of objects and correct perception of form. They also involve the ability to follow directions. The texts of these tests are too complex to be reprinted here, but each indicates the formation of a habit at the level essential to accurate passing of the test.

The following Normative Summaries* for ages twelve months, eighteen months, and two years give further indications of the number and types of responses which may be expected to have developed during the first twelve months and during the second year.

Twelve Months

Motor characteristics:

- Stands with support
- Creeps or hitches alone
- Walks with help
- Shows a preference for one hand in reaching
- Scribbles imitatively with a crayon

Language:

- Comprehends simple verbal commissions
- Says two words beside *Mama* and *Dada*
- Can wave *bye bye* and often can say it

Adaptive behavior:

- Places a cube in a cup on command
- Recovers a cube concealed by a cup
- Retains a cube in either hand and takes a third
- Puts a small rod in a half-inch hole

* Gesell (12). This book contains an excellent treatment of the development of children from infancy through five years of age.

Personal-social behavior:

- Plays with or reaches for his mirror image
- Cooperates while he is being dressed
- Holds a cup to drink out of and may use a spoon
- Plays with blocks but not very constructively
- Inhibits simple acts on command
- Imitates simple acts like scribble and spoon rattle

Eighteen Months

Motor characteristics:

- Walks alone
- Climbs chair or stair
- Throws ball into box
- Scribbles spontaneously

Language:

- Says five or more words
- Comprehends simple questions
- Points to nose, eyes, or hair
- Says *Hello, Thank you*, or equivalent

Adaptive behavior:

- Accepts fourth cube and retains three
- Builds blocks in tower, imitatively
- Places circular block in form board

Personal-social behavior:

- Uses spoon without much spilling
- Bowel control practically established
- Shows dramatic mimicry in play
- Habitually inhibits certain acts
- Tries, definitely, to put on shoes
- Plays combiningly with cup and cube

Two Years

Motor characteristics:

- Draws a vertical stroke imitatively
- Plays simple catch and toss with ball
- Can operate a kiddy-car around a chair

Language:

- Uses simple sentences and phrases
- Names familiar objects like key, penny, watch
- Distinguishes *in* and *under*
- Points to seven of ten simple pictures

Adaptive behavior:

- Builds a block tower of three or more
- Places three blocks in form board
- Folds paper once imitatively

Personal-social behavior:

- Bladder control established
- Listens to stories with pictures
- Tells experiences
- Asks for things at table by name
- Likes to play in sand, filling and emptying

Gesell states, "These summaries are condensed, tabular characterizations of the ascending developmental levels from four months to the age of six. They are intended to serve as thumb-nail sketches. The strokes in these sketches are too few and too short to make a symmetrical picture, but the delineations are concrete and objective, and it is hoped that they will fill their purpose, which is clinical rather than aesthetic. They are called normative because they are to be used as standards for orientation."

Transfer of Learned Elements. If one were to draw conclusions on the basis of practical experience and of such studies as that of McGinnis (26), one would probably say that, in the transfer of training, the same phenomena are present in young children as in adults—*i.e.*, the transfer may be positive, it may be negative, or it may not occur. McGinnis trained her subjects on mazes, the patterns of which could be changed. She found a positive transfer from one maze pattern to the next.

Instances of no transfer have been noted above. Instances of negative transfer or interference may be observed in everyday practical experience, though they have not yet been measured in terms of laboratory experimentation.

Personal-social behavior:

Plays with or reaches for his mirror image
Cooperates while he is being dressed
Holds a cup to drink out of and may use a spoon
Plays with blocks but not very constructively
Inhibits simple acts on command
Imitates simple acts like scribble and spoon rattle

Eighteen Months

Motor characteristics:

Walks alone
Climbs chair or stair
Throws ball into box
Scribbles spontaneously

Language:

Says five or more words
Comprehends simple questions
Points to nose, eyes, or hair
Says *Hello, Thank you,* or equivalent

Adaptive behavior:

Accepts fourth cube and retains three
Builds blocks in tower, imitatively
Places circular block in form board

Personal-social behavior:

Uses spoon without much spilling
Bowel control practically established
Shows dramatic mimicry in play
Habitually inhibits certain acts
Tries, definitely, to put on shoes
Plays combiningly with cup and cube

Two Years

Motor characteristics:

Draws a vertical stroke imitatively
Plays simple catch and toss with ball
Can operate a kiddy-car around a chair

Language:

- Uses simple sentences and phrases
- Names familiar objects like key, penny, watch
- Distinguishes *in* and *under*
- Points to seven of ten simple pictures

Adaptive behavior:

- Builds a block tower of three or more
- Places three blocks in form board
- Folds paper once imitatively

Personal-social behavior:

- Bladder control established
- Listens to stories with pictures
- Tells experiences
- Asks for things at table by name
- Likes to play in sand, filling and emptying

Gesell states, "These summaries are condensed, tabular characterizations of the ascending developmental levels from four months to the age of six. They are intended to serve as thumb-nail sketches. The strokes in these sketches are too few and too short to make a symmetrical picture, but the delineations are concrete and objective, and it is hoped that they will fill their purpose, which is clinical rather than aesthetic. They are called normative because they are to be used as standards for orientation."

Transfer of Learned Elements. If one were to draw conclusions on the basis of practical experience and of such studies as that of McGinnis (26), one would probably say that, in the transfer of training, the same phenomena are present in young children as in adults—*i.e.*, the transfer may be positive, it may be negative, or it may not occur. McGinnis trained her subjects on mazes, the patterns of which could be changed. She found a positive transfer from one maze pattern to the next.

Instances of no transfer have been noted above. Instances of negative transfer or interference may be observed in everyday practical experience, though they have not yet been measured in terms of laboratory experimentation.

Retroactive inhibition has not yet been demonstrated in the learning of young children, but it is probable that it too appears as one of the factors influencing the rate of learning.

Acts of skill once acquired by the long process of trial and error may or may not help in the formation of other habits in which the same activities are involved. Transfer appears to occur only when the child perceives the activities as similar. This failure of habits to transfer is as true of all habits as it is of those involving acts of skill. A habit of obedience which is set up in one situation may or may not transfer to others.

Practical Applications of the Laws of Habit Formation. It is interesting to note that a knowledge of the laws of habit formation will sometimes enable one to analyze the conditions surrounding the performance of a bad habit in such a way as to break it with relative ease. In the same way, a knowledge of these laws enables one to determine the reasons why a good habit is not being set up.

In the case of a bad habit, the following conditions should be examined:

Is there in the environment a stimulus which is bound to produce the undesirable reactions? For example, in the case of nail biting, are there loose edges around the nails which are continually attracting the child's attention? In the case of thumb-sucking, is there some irritation of the gums which causes the child to stimulate them continually with the thumb or finger, or is the child hungry, or is there some other physical condition which presents a constant stimulation in response to which this habit must go on?

Is the undesirable activity actually producing pleasant results, for example, does it make the child the center of attention and the cause of excitement? A four-year-old who refused to sleep during his nap period was for that reason the continual topic of conversation both among his family and among the acquaintances who came to his home. A second child's appetite showed extreme finickiness from the same cause.

Is the child actually being paid for his undesirable activity? The writer has twice had in a nursery group children, who, when they refused to eat vegetables at dinner, were given slices of cake and ice cream on their return home only on the days on which their appetites for normal foods appeared slight and they had refused food at dinner. Only a marked increase in the number of days in which they preferred ice cream and cake to food showed the parents that these children were being rewarded for lack of appetite.

Have other outlets been found for the undesirable activity; *i.e.*, has any attempt to find a substitute activity been tried? Gates and others have stated clearly that a child who has been told not to do a particular thing and has even been punished will finally find that not doing the act is more disagreeable than the punishment which will be inflicted after he does it. Such treatment rarely causes a permanent cessation of undesirable activities.

Finally, if other methods have been tried and have failed, have undesirable results been attached to the bad habit and uniformly? It is sometimes necessary to add punishment to a situation where one wishes an undesirable activity to be eliminated. If punishment is used in connection with

undesirable activities, the punishment should come whenever the undesirable activity appears. There should never be occasions in which the child can have a successful outcome for an undesirable activity. It frequently happens in eliminating bad habits that punishment is administered only infrequently. Where this is the case, the habit can be expected to continue to function.*

In the case of a desirable activity which it seems difficult to set up as a habit, one should ask oneself the following questions:

Has the child had sufficient opportunity to practice this activity; in a word, has the stimulation which produced this activity been forthcoming frequently enough? In a case of the writer's a child practiced being polite only when company came to the house. As company appeared only infrequently, the average number of practices per week was less than one. As will be pointed out frequently throughout the book, the memory of young children is very short. They are willing to repeat over and over again material to be learned. If the repetitions are spaced too far apart, the child forgets from one repetition to another and the habit may not be set up for months or even years if it is set up at all.

Have unpleasant results been coupled with the activity which one desires to set up? It is no unusual thing to hear a child scolded again and again for his table manners or to have him punished in connection with the presentation of wholesome foods. In this instance, unpleasant results are unquestionably associated with the activity which one wishes to become habitual.

* See earlier discussion under Law of Intensity.

Have undesirable activities been practiced as frequently as the desirable ones? If a child has washed his hands before eating some days and has not washed his hands other days, he has practiced eating with soiled hands as often as he has practiced eating with clean ones. Both habits have an equal chance to be set up. The one which is most pleasant for him will tend to be selected or he may continue to have both habits function—he may wash his hands before some meals and at others avoid the washing process.

Results of Habit. An activity once learned is performed with less effort and with more rapidity and accuracy than it was in the initial stages during which mastery was being gained. An habitual activity requires little direction. So true is this that a number of activities may go on simultaneously, provided that they have reached the habit plane. It is to the child's advantage to reduce to the plane of habit all those things which are necessary for his everyday activities. Feeding, sleeping, the whole hygiene of rest and nutrition, and the bedroom and bathroom habits should be well established by the end of the fourth year. The result of the establishment of such habits is to free the child's attention to cope with those new situations which are constantly arising, particularly when he reaches kindergarten and school age.

Health habits which have to do with reactions of the child to food are particularly important. Malnutrition appears to be as common in children from good homes as it is among children from poor ones. Faulty food habits is cited as the fourth of the five causes of malnutrition given by Dr. Emerson.* Faulty food habits are the direct results

* "The Child, His Nature and His Needs," chap. IX, p. 187, Children's Foundation, Valparaiso, Indiana.

of wrong conditioning. In many cases, they result from the fact that a fundamental law of habit formation has been disregarded. Activities which are disagreeable in their result tend to be inhibited rather than perpetuated. Children who are forced to eat healthful foods frequently acquire a distaste for such foods which is so strong as to persist through life and to make the actual eating of such foods often harmful in its effect rather than healthful. The same foods, associated with a pleasant dessert which followed them, would become interesting. Attaching pleasant results to food habits should be a part of the educational program of all nursery schools. Such establishment of pleasant results in connection with proper food habits should not be confused with overattention during the meal period. It is perfectly possible to have the meal hour become a story hour to such an extent that the food itself is more or less neglected or that the child uses the pretext of not eating as a means of getting stories and plays at mealtimes.

EXERCISES

I. Make a habit inventory for your subject.

Compare this with a habit inventory of a child one year younger.

Compare this record with those of other children of the same age.

Draw conclusions

A. As to the number of habits acquired

B. As to the performance of your subject in comparison with that of other children of the same age

If this study is to be carried on over a long period, the child's performances may be compared with his own earlier records. The first comparison made should be with another child of the subject's age.

II. Observe the behavior of your subject in a learning situation.

For this choose a simple habit which the child seems to be in the early

stages of acquiring. (Dressing and undressing and learning to eat are excellent habits to observe.)

Study the way in which results, pleasant or otherwise, are attached to the child's responses.

If possible, make a curve showing the amount of time consumed in a single operation, for example, putting on and buttoning a coat. This curve should represent practice for at least one month, preferably longer.

Describe the conditions which produced variations in the curve.

Bibliography

1. Angell, James R.: "Psychology," Chap. III, Henry Holt and Company, Inc., New York, 1908.
2. Book, W. F.: "Psychology of Skill," *Bulletin* 53, University of Montana Publications in Psychology.
3. Bryan and Harter, "Studies in the Physiology and Psychology of the Telegraphic Language," *Psychological Review*, **4**: 53; **6**: 348–375.
4. Carr, H. A.: "Psychology: A Study of Mental Activity," Chap. V, Longmans, Green and Company, New York, 1925.
5. Cason, H.: "The Conditioned Pupillary Reaction," *Journal of Experimental Psychology*, **5**: 108–146, 1922.
6. Colvin, S. S.: "The Learning Process," Chaps. III, IV, The Macmillan Company, New York, 1917.
7. Curti, Margaret W.: "Child Psychology," p. 457, Longmans, Green and Company, New York, 1940.
8. Dunlap, Knight: "Habits, Their Making and Unmaking," Liveright Publishing Company, New York, 1932.
9. Fenton, Jessie D.: "A Practical Psychology of Babyhood," Chaps. IV, V, Houghton Mifflin Company, Boston, 1925.
10. Freeman, F. N.: "How Children Learn," Chaps. VIII, IX, Houghton Mifflin Company, Boston, 1928.
11. Gates, A. I.: "Psychology for Students of Education," The Macmillan Company, New York, 1937.
12. Gesell, Arnold: "The Mental Growth of the Pre-school Child," The Macmillan Company, New York, 1925.
13. Goodenough, Florence, and Bryan, C. R.: "Certain Factors Underlying the Acquisition of Motor Skills by Preschool Children," *Journal of Experimental Psychology*, **12**: 125–127, 1929.
14. Gutteridge, M. B.: "A Study of Motor Achievements of Young Children," *Archives of Psychology*, No. 244, 1939.

15. HICKS, J. A.: "The Acquisition of Motor Skill in Young Children," *University of Iowa Studies in Child Welfare*, No. 4, 1931.

16. HOSKINS, R. H.: "The Tides of Life," W. W. Norton & Company, Inc., New York, 1933.

17. HUDGINS, C. V.: "Conditioning and Voluntary Control of the Pupillary Reflex," *Journal of Genetic Psychology*, **8**: 3–51, 1933.

18. IVANOFF-SMOLENSKY, A. G.: "On the Methods of Examining the Conditioned Food Reflexes in Children and in Mental Disorders," *Brain*, **50**: 138–141, 1927.

19. JENSEN, A. S.: "Psychology of Child Behavior," Prentice-Hall, Inc. New York, 1938.

20. JERSILD, ARTHUR T.: "Child Psychology," Prentice-Hall, Inc., New York, 1940.

21. JONES, MARY C., "The Development of Early Behavior Patterns in Young Children," *Pedagogical Seminary and Journal of Genetic Psychology*, **33**: 537–585, 1926.

22. KANTROW, R. W.: "An Investigation of the Conditioned Feeding Responses and Concomitant Adaptive Behavior in Young Infants," *University of Iowa Studies in Infant Behavior*, IV: 13, 1937.

23. KASATKIN, N. I., and A. M. LEVIKOVA: "On the Development of Early Conditioned Reflexes and Differentiations of Auditory Stimuli in Infants," *Journal of Experimental Psychology*, **18**: 1–19, 1935.

24. KRASNOGORSKI, N. I.: "Bedingte und unbedingte Reflexe in Kindesalter und ihre Bedeutung für die Klinik," pp. 663–666, Verlag Julius Springer, Berlin, 1931.

25. KUHLMAN, "A Handbook of Mental Tests," Warwick and York, Baltimore, 1922.

26. McGINNIS, ESTHER, "The Acquisition and Interference of Motor Habits in Young Children," *Genetic Psychology Monographs*, Vol. VI, No. 3, September, 1929.

27. MARQUIS, D. P., "Can Conditioned Responses Be Established in the Newborn Infant?" *Pedagogical Seminary and Journal of Genetic Psychology*, **39**: 479–492, 1931.

28. MARTIN, LILLIEN G., and CLARE DE GRUCHY: "Mental Training for the Pre-school-age Child," p. 29, Harr Wagner, San Francisco, 1923.

29. MORGAN, JOHN J. B., and SARAH S. MORGAN: "Infant Learning as a Developmental Index," *Journal of Genetic Psychology*, **65**: 281–289, 1944.

30. NORSWORTHY, NAOMI, and MARY WHITLEY: "Psychology of Childhood," Chap. XI, The Macmillan Company, New York, 1918.

31. PAVLOV, IVAN: "Lectures on Conditioned Reflexes," Oxford University Press, New York, 1927.
32. ROWE, E. C.: "The Resemblance of Triplets," *Journal of Heredity*, **19**: 175–176, 1928.
33. SHAW, KATHERINE: "A Study of Learning in Young Children," a Master's Thesis in the Library of the University of Cincinnati.
34. SWIFT, E. J.: "Mind in the Making," Charles Scribner's Sons, New York, 1908.
35. TERMAN, LEWIS M., and MAUD A. MERRILL: "Measuring Intelligence," Houghton Mifflin Company, Boston, 1937.
36. THORNDIKE, E. L.: *Educational Psychology*, Vols. I–III, Lemcke & Buechner, New York, 1903.
37. THORNDIKE, E. L., *et al.*: "Adult Learning," The Macmillan Company, New York, 1928.
38. WARNER, L. H.: "An Experimental Search for the 'Conditioned Response,'" *Pedagogical Seminary and Journal of Genetic Psychology*, **41**: 91–115, 1932.
39. WENGER, M. A.: "An Investigation of Conditioned Responses in Human Infants," in "Studies in Infant Behavior," *University of Iowa Studies in Child Welfare*, **12**: 9–90, 1936.
40. WELLMAN, B.: "Motor Achievement of Preschool Children," *Childhood Education*, **13**: 311–316, 1937.

Chapter - - - - - - - - - - - - - - - - Nine

SENSATION, PERCEPTION, AND PERCEPTUAL LEARNING

PERCEPTUAL REACTIONS ARE ALSO IN THE NATURE OF habits. By perception is meant the stimulus present to sense plus its meaning or meanings. This process involves the stimulation of the sense organs plus more or less wide-spread cortical reaction. The first sensations of the infant carry little or no meaning, but, once stimulation has been reacted upon, meanings appear.

The meaningful content of any stimulus or any set of stimuli is poor and restricted in the first year of life inasmuch as the stimuli themselves may be reacted upon inadequately and the experience of the infant is limited.

The perceptual process, then, depends in part upon the condition of sense organs and in part upon experience. Authors have occasionally stated that infants do not hear in the first 48 hours of life, since there appears to be a certain amount of mucus in the ear which does not clear completely until the second day. This conclusion has been questioned by Pratt (22) and by Irwin and Weiss (15). The reactions reported by Weiss and Pratt, however, may have been a response to jarring rather than to sound.

The eyes do not function well because the whole accessory mechanism has yet to be brought under control. The two eyes do not work together, and it is doubtful if the lenticular accommodation is in much better case. Beasley (3) suggested that the child can see clearly shortly after birth but agrees that the ability to coordinate eye muscles does not develop until some weeks after birth, which is in line with our conclusion that the child cannot see clearly with both eyes until approximately the end of the third month of life.*

The first relatively clear sensations† which the infant receives probably come from the internal organs (organic sensations) and from the organs of taste, touch, and temperature. Contact and temperature sensations occur at birth, and indeed they are probably present in the prenatal period. Taste functions shortly after birth, as soon as the infant begins to nurse. The mouth area is singled out from this period to late infancy to mediate not only taste sensations but contact and temperature sensations as well. These come first from feeding and then from the reflex and random activities through which anything which the hands grasp is brought to the mouth. This has the double advantage of giving contact and temperature sensations from the tongue and lips, which appear to be highly sensitized, and of giving taste sensations.

* See also Bing-Chung Ling (19).

† For a full summary of earlier literature see W. Preyer, "Embryonic Motility and Sensitivity," *Monographs of the Society for Research in Child Development*, Vol. LL, No. 6 (Serial No. 13), 1937. See also L. W. Sontag and T. W. Richards, "Studies in Fetal Behavior," *Monographs of the Society for Research in Child Development*, Vol. III, No. 4 (Serial No. 17), and Kai Jensen, "Differential Reactions to Taste and Temperature Stimuli in Newborn Infants," *Genetic Psychology Monographs*, Vol. XII, Nos. 5, 6, November, December, 1932.

At the same time that the senses of taste and contact are being stimulated from the mouth area, the child is getting sensations of sight and smell, as well as contact sensations in the hands, and sensations in the tendons, muscles, and joints (kinesthetic sensations), which will later serve to indicate to him the relative position of his hands and arms and the size and nature of the object which he is grasping. The infant spends the first few months of his life in random manipulation of everything with which his hands come in contact. His inherited tendencies to manipulation result in a constant series of stimulations of the organs for the reception of stimuli, and in consequence of these stimuli yet further impulses to movement are sent out from the coordinating and controlling mechanism to the organs of response. On the basis of the sensory experiences which the young child receives, all later perceptions are built up; on the basis of the movements which he makes in response to sensory stimuli and such random movements as are brought into play, all control of movements is developed. Manipulation serves the double purpose of giving him control of his own muscular system and of giving him knowledge of the external world. Toys and apparatus which are supplied to infants and young children should be such as can be pushed, pulled, kicked, rolled, thrown, and even tasted. They should supply all types of surfaces in order that rough, smooth, hard, and soft may be experienced. They should be different in size, shape, and weight in order that children may begin to lay a foundation for the perception of these qualities.

Sensation in Infancy. At the beginning of the infant's life, it is doubtful whether any of his sensations have the same degree of clearness and definiteness which they will

come to have when he has had sufficient experience to analyze each experience into its components and to synthesize under a common heading experiences which have hitherto appeared to belong in several fields. For example, if one takes the sensory experience which the child derives from a silver spoon, it could probably be resolved roughly into a kind of hardness, brightness, and coolness, plus the sound which the spoon makes as it hits against other objects when moved by the baby, and the slight metallic taste which it has when placed in the baby's mouth; no clear perception of the shape of the object would, of course, be possible. After the first experiences with the mediating sensory qualities, the child's reaction to the object would be that of sensation plus meaning, in a word, perception rather than a group of sensations.

As a matter of fact, it is doubtful whether anything which can be called pure sensation, that is to say, anything which does not involve the perceptual process, can be experienced by an infant within the first few hours after birth. When we speak of the sensations of the infant, we are dealing with the same sort of abstraction which we have when we speak of sensation in introductory psychology.

Dependence of Perception on Maturity. The perceptual process in young children differs as widely from the perceptual process in adults as does the reaction of the infant to a spoon from the reaction of the trained college student to the same object (36). Further discussion of our illustration will serve to prove this point. From the perception of the spoon as a hard, cool, smooth object of undifferentiated shape which has a metallic taste when sucked, the child comes next to the knowledge of the spoon as an object with which to convey food to the mouth, and the meaning

which surrounds the spoon as an object is enormously increased. As he becomes more and more mature, the spoon may come to mean to him an instrument for measuring, a thing of different sizes and shapes, as dessert spoon or tablespoon, and made of different materials, such as brass, copper, silver, or pewter. As his knowledge of spoons progresses, he begins to differentiate between souvenir spoons and spoons for table use, between spoons which represent a particular period and have deep historical significance and those which are merely for cooking purposes. He learns that spoons may be of different sizes and shapes and that they may be made of brass, silver, copper, pewter, and many other materials. So full of meaning may such a simple article as a spoon become that the mere perception of one made in the Colonial period or the Renaissance period may suffice to bring to the mind of the college student a series of historical events. The perception of the college student who sees in a pewter spoon made during the Colonial period an indication of the life and history of that time differs widely, even under the most superficial analysis, from the infant's perception of the hard, bright, cool, sound-producing, metallic-tasting object of undifferentiated shape.

Dependence of Perception on Experience. Children's perceptions of objects depend (*a*) upon previous experience and (*b*) upon the condition of the sense organs. An object which has been in a child's immediate environment may be perceived but poorly, if he is not allowed to have every possible contact with it. The perception of a puppy, which the child has merely seen but has not been allowed to touch or to have any other experience with, would be a more or less undifferentiated mass which moved and, probably,

sound made by the dog in scratching on the floor and in barking. If the child is allowed to touch the animal, he gets additional sensory experiences of contact and warmth. He also gets sensations of weight, shape, and size when he lifts the dog. His perception is further enriched by play in which he sees the puppy roll, walk, and run, and hears it growl, bark, and whine. The perception of this object by a child who has experimented with it cannot be compared with the perception of the same object by a child who has merely seen the puppy and heard the variety of noises which the puppy can make. Children perceive clearly only after they have had the opportunity to experiment with objects in every way. The preschool period is preeminently the period for this experimentation. Children begin by experimenting with their own limbs and bodies and carry on this experimentation with every object which they are allowed to touch. Since contact and taste sensations form a large part of a child's early perception, it is natural that he should wish to get contact sensations from the lips and tongue and, therefore, that he should put all objects which he handles into his mouth.

In spite of children's tendency to experiment widely, they frequently do not see common objects with which they come in contact, unless such objects are pointed out to them and their most outstanding characteristics noted. Hall (12), in 1880, conducted experiments to determine the contents of children's minds at the time at which they entered school. The experiments were conducted with children entering Boston schools. The children were questioned three at a time by "four trained and experienced kindergarten teachers." Sixty other teachers made returns for three or more children each. The amount of ignorance

of common objects revealed by this investigation was extraordinary. In spite of the fact that some criticisms may be advanced against the method of collecting the data, the results are sufficiently accurate to make this ignorance of common objects clear. Hall states:

> Skeins and spools of thread were said to grow on the sheep's back or on bushes, stockings on trees, butter to come from buttercups, flour to be made of beans, oats to grow on oaks, bread to be swelled yeast, trees to be stuck in the ground by God and to be rootless, meat to be dug from the ground, and potatoes to be picked from trees. Cheese is squeezed butter, the cow says "Bow-wow," the pig purrs or burrows, worms are not distinguished from snakes, moss from the "toad's umbrella," bricks from stone. . . . While no one child has all these misconceptions, none are free from them and thus the liabilities are great that in this chaos of half-assimilated impressions, half right, half wrong, some lost link may make utter nonsense or mere verbal cram of the most careful instruction, as in the cases of children referred to above, who knew much by rote about a cow, its milk, horns, leather, meat, and so on, but yet were sure from the picture book that it was no bigger than a small mouse.

A daily walk with the child or outdoor play with him, in which a large part of the game consists in pointing out common objects, giving them names, telling the child about them in simple language, and letting him experiment with them, is an excellent way both to develop adequate concepts and to ensure that the child perceives clearly. It is also a most interesting game for the child.

Perception of Similarities. Similarities between objects or situations depend largely upon the experiencing individual. Similarity may be so simple a thing as the perception of the roundness of the moon as being similar to the roundness of a ball; of the light of the moon as being similar to the light of a round street lamp, in which case there may be a perception of the similarity of both roundness

and light in the two objects. Similarities between common objects are not easily perceived by young children, inasmuch as their experience is so slight that they do not analyze even common objects into their component qualities. Adults are surprised to discover that even so simple a quality as the color blue will not be perceived by the child as similar when the color is found in dresses, blocks, and the sky. It is only by a multiplication of such experiences as the color, shape, distance, direction, and number that the child is able to determine the similarity between these qualities as they are found in objects and situations. Children's inability to perceive similarities between objects which to adults are obviously alike is one of the common causes of misunderstanding between parents and children. To the adult a situation may appear to demand behavior taught under conditions apparently similar, while to the child the second situation may be wholly unlike the first. A child may obey his mother but not give obedience to the same commands given by his grandmother when he visits her. The process of education concerns itself in large measure with the discovery of similarities, *i.e.*, with points of relation between things which on the surface appear wholly dissimilar. The chemist points out the relation between carbon as it appears in coal and in the diamond; the physicist, the relation between the liquid and solid states involving many of the same elements; the psychologist, the relation between stimuli to one type of response and to behavior which appears to be wholly unrelated to the stimuli which called it forth.

Perception of similarities not observed by the ordinary mind is one of the characteristics of genius. Newton's perception of the falling apple as an instance of the opera-

tion of the laws of gravitation and the later observation of equally true instances of this law is a good illustration of this point. Inventions constantly illustrate the basis of similarities in objects which to the common mind are wholly dissimilar—the operation of gliders in the airplane, the perception of the relation between the operation of steam in the kettle and steam as it operates in propelling steam engines, and so on. Perceptions of remote similarities as a precondition of interesting imagery in poetry may be multiplied indefinitely. Angell cites as an illustration of this a few lines from Andrew Lang's sonnet, "The Odyssey":

> So gladly, from the songs of modern speech
> Men turn,.....................................
> And through the music of the languid hours,
> They hear, like ocean on a Western beach
> The *surge* and *thunder* of the Odyssey.

Two faulty perceptions which occasionally develop into social attitudes are treating animate objects as if they were inanimate and treating inanimate objects as if they had life.

The first of these—treating animate objects as if they were inanimate—is an attitude which is clearly observable, particularly in the early stages of the preschool period, that is, between one and two. At this time, the child will pull the hair of adults who play with him, take large handfuls of cheeks of other children, pinch them and pull them about without any intention of inflicting pain. This attitude is probably derived in part from another fundamental attitude in the child, *i.e.*, number two on our list, the tendency to treat inanimate objects as if they had life.

There are numerous instances of the tendency to assume

life in inanimate objects which parallel the following illustrations quoted from Tanner (31):

> Jean Ingelow tells us that when she was a little girl she was sure that stones were alive, and felt very sorry for them because they always had to stay in one place. When she went walking, she would take a little basket, fill it with stones and leave them at the farthest point of the walk, sure that they were grateful to her for the new view. Another little girl thought that the leaves were alive, and autumn was a mournful time to her because the leaves all had to die. Moving things are likely to be personified, especially if they are noisy. Machinery, engines, and steamers are terrific personalities to the little child. But he also personifies his moving toys, his ball, and his hoop. Even a sliding cushion was given life by one small boy. It seems odd to us that children should think of such things as growing, but a goodly number of them do.

Children play with their dolls as if they were alive, feeding them and assuming in the doll a sort of human response. This same object they may pick up by its hair or by one arm, or carry with the head hanging down, and inflict no pain and receive no protest from the object so treated. It is natural enough that they try this same sort of play with other children and even with adults. It is only when such treatment is resented and when the child himself has experience with being treated in this way that he learns that some objects may be handled roughly, while others, *viz.*, his playmates and his adult companions, must be experimented with less roughly. In some children this process of learning appears to be very slow. Its rapidity is greatly increased by the kind of social contacts and checks children receive during the nursery-school period.

Relation of the Sense Organs to the Perceptual Process. Since perception is founded primarily on the extent to which the sense organs are functioning normally, slight sensory defects will often change to a marked degree the reactions

of children to objects. Difficulties in binocular coordination which produce blurred vision will often result in very inadequate recognition of objects with which the child has often had sensory experience. Even where recognition is complete, the properties of the object may differ widely from the perception of the object discerned. Things may be perceived to have a shape which is quite foreign to them. Children who suffer from astigmatism (slight inequality of curvature in the lens), which also produces blurred vision, perceive objects inadequately and also develop reactions to space relations which are so poor as often to result in their bumping into objects and reaching for objects which are too distant to be touched. Various other difficulties in adjustment to space relations are the result of eye defects.

Similar difficulties in perceiving clearly arise from hyperopia (farsightedness) and myopia (nearsightedness). These defects can hardly be corrected in the preschool period, but a thorough physical examination which includes an eye examination should be made as soon as the child is mature enough for specialists to determine whether inaccuracies of vision are merely due to his age, or whether they result from some recognizable visual defect. In the early preschool period, what appears to be a visual defect is often due to immaturity of function and limited experience, both of which will correct themselves as the child grows older.

Other difficulties in visual perception may arise from the fact that the child is color-blind. In a small percentage of cases, there is an actual inability to see red and green qualities, and in a still smaller percentage there appears to be an inability to see blue and yellow. In cases of color blindness, red and green are confused with each other and

with corresponding shades of gray, *i.e.*, shades of gray that have a brightness value equal to that of the shade of red or green with which they are confused. Some children, while not actually color-blind, react correctly only when colors have a high degree of intensity.

Auditory defects result in inaccurate perceptions. in that field. A slight deafness will often cause a child to hear so poorly that he develops a wrong conception both of the spelling of words and of their meaning. Moreover, since he hears words peculiarly, he frequently mispronounces them. He may even appear to have somewhat of a speech defect which is the direct result of inaccurate auditory perception. Total deafness appears to retard language development to such an extent that the child remains almost wordless until taught by special methods.

Children are probably more sensitive to touch and temperature than are adults, inasmuch as there appears to be the same number of end organs in young children as there are in adults. There must, therefore, be a larger number in each area in the small child than there are in the adult. The taste buds appear to have somewhat different distribution in young children. Here they occur in the cheek areas, which accounts for the delight the child appears to have in stuffing his mouth.

Special Perceptions. *Perception of Color.* Color discrimination in young children has been studied by a large number of experimenters. Miss Shinn (28) reports several observations and some experimental work on her niece's ability to discriminate color from birth to three years of age. When her niece was six months old Miss Shinn used red, yellow, blue, violet, orange, pink, and green ribbons and

allowed the child to make a choice among them. Blue and violet were noticed seldom. Green was noticed least. When she changed the degree of illumination by placing blue, violet, and green in a strong light and yellow, orange, red, and pink in a weak one the child appeared to prefer the former. Her results indicate that brightness in color determine their choice. In conclusion she states that from the fourth week until the end of the first year her niece discriminated in terms of light and color. Light is probably used to mean brightness.

Baldwin and Stecher (2) used sorting cards to determine color discrimination at three years of age and at four. The children made 26.3 per cent correct placings at three years old and 48.8 per cent at four years, indicating that even at three their color discrimination was far from perfect. Cook (6) studied color discrimination in 110 children from seventeen months to six years of age. The three tests used by this experimenter involved both verbal and nonverbal responses. In tests 1 and 2 she used red, green, yellow, and blue squares of colored paper mounted on a background of gray and placed on a table covered with gray cardboard. Both brightness and saturation were studied. In series 1 the squares were constant in hue and brightness but varied as to degree of saturation. In series 2 saturation and hue were constant and brightness varied. The children were asked to give each color name after they had matched it. She found color naming inaccurate to four years and six months to five years of age. Matching was inaccurate in younger children, except as to red.

Staples's (20) work on young infants from 69 to 113 days old consisted of the presentation of the four primary colors mounted on gray disks. All four colors were also in the

form of disks. The disks were placed on a screen attached to the baby's crib by a movable arm. The experimenter was able to watch the baby through a hole in the screen without herself being seen. The responses of the infant were measured in terms of grasping. Staples states that infants three months of age may perceive color to a certain degree. By the fifteenth month children see saturated red, green, yellow, and blue. The results of this last author are somewhat open to question, inasmuch as there is no indication whatever that these infants were not reacting in terms of brightness rather than color.

Luken's (20) studies of color discrimination in 100 children two, three, and four years of age give a somewhat clearer picture than do any of the preceding studies.

The subjects for Luken's experiments were members of nursery schools and day nurseries in the city of Cincinnati. They represented a rough cross section of the population. The material used in the experiment was the Holmgren worsteds. The worsteds chosen from the complete set were the four sample shades of blue, green, yellow, and red and tints of each of these colors. The four shades taken as samples were matched with the red, green, yellow, and blue used in the color tests of the Stanford revision of the Binet tests. Ten shades of violet, one white, twelve brown, and eleven gray were used as "confusion colors." The samples of the four primary colors, blue, green, yellow, and red, were matched with Abbot Educational Color Chart IV. The colors were numbered from 1 to 10. The number 1 represented the lightest and 10 the darkest shade of each series. The four sample colors were kept in an envelope; all other colors were arranged in chance order to familiarize them with the feel of the wool. The experimenter removed

the blue sample from the envelope and held it before the child saying, "See this color? Can you find me another color like this one on the table? If you can, then pick them up and give them to me." If a child hesitated the experimenter picked up several shades of blue and said, "See, these colors are like this one. Now you find some like this one." She then laid the wools on the table. When the child said that he had found all the blues or when he picked up a handful of worsteds and handed them to the experimenter the test was considered completed. The same procedure was followed with the three remaining colors. Each subject went through the test in the way described twice on two days not more than one week apart. Each subject received therefore four trials for each color. There was no time limit set for these tests.

Group A consisted of children from two to two years and six months, group B of children from two years six months to three years, group C of children three years to three years and six months, group D children three years and six months to four years. The following table gives the results.

TABLE VI.—PERCENTAGE OF CORRECT CHOICES FOR EACH COLOR AT EACH AGE

Colors	Group A	Group B	Group C	Group D
Blue	16.41	38.44	56.20	65.04
Green	11.63	55.85	80.75	97.46
Yellow	18.14	58.80	84.16	93.57
Red	17.44	49.77	66.01	71.38

The inability of two-year-olds to match colors correctly can be clearly seen from this table. The increase in color discrimination for two to four years of age is equally clear,

since between three years and six months and four years of age children make 97.46 per cent correct choices of green and 93.5 per cent correct choices of yellow, selecting correctly all shades of these colors. The relatively poor showing in red and blue are partially explained by the fact that brown was frequently confused with blue and that pink failed to be recognized as a shade of red. The relation of the development of color discrimination as shown by these experiments to the color theories leaves much to be explained. That color discrimination is exceedingly poor, in fact, almost nonexistent, at the age of two is hardly open to question.

These results were not due to a language confusion nor, so far as the experimenter could determine, to any factor other than inadequate perception of colors which at later ages were seen to differ widely from each other. Cook's experiments, previously cited, also indicated the same inability to perceive color differences.

Color preferences in children have also been studied in the laboratories at the University of Cincinnati.

There is no doubt that the average child two years of age and younger does not perceive differences in color. There is some evidence that even at three years of age children's color preferences are not strong. This conclusion has been drawn both by Dashiell (7) and as a result of experiments conducted in the preschool laboratory at the University of Cincinnati. (1) The subjects for this latter experiment were white and Negro children aged from three years to three years and eleven months. The tests* used

* For the procedure used in giving these tests we are indebted to Miss Marian Monroe, who was conducting an experiment on the same lines at the Merrill Palmer School.

were (*a*) a doll-dressing test in which color preferences were determined by the order in which silks in the primary colors were chosen to dress dolls; (*b*) a painting test in which the color preferences were determined by the order in which paints were chosen and the number of times each color was used to "make a picture"; (*c*) a drawing test in which the color preferences were determined by the order in which colored chalks were chosen and by the number of times each color was used.

In the painting test the four primary colors were used; in the drawing test the chalks were red, yellow, blue, green, brown, orange, and purple. The choices of the white, and to some degree, of the Negro children were influenced by the order in which the colors were presented. The white children tended strongly to choose the colors in left-to-right order. Choices were even more markedly influenced by the materials used in the experiments. A child might choose red as his first choice in silks, purple as his first choice in chalks, and blue as his first choice in paints. Only two children chose the same color first in all three experiments. As has been stated previously, Dashiell drew much the same conclusion as our own from series of experiments conducted to determine color preferences in young children, *viz.*, that color preferences in young children are very slight.

Material from intelligence tests indicates that the ability to name the four primary colors develops relatively late. Successfully naming four colors appears in the five-year-old test in the Stanford revision of the Binet tests.

Perception of Time. Literature on perception of time by children before five years of age is inadequate. Elkins

(9) experimented on the time sense of children from ten to fifteen years of age, but these experiments throw no light on the development of the perception of time at earlier levels.*

The Stanford revision of the Binet test places the perception of segments of the day, or morning or afternoon, at the six-year level. A child of nine years of age, according to the Stanford revision, can tell the day of the week, the month of the year, and the date.

The perception of time is very vague in the preschool period. The three-year-old differentiates between night and day but does not perceive the difference between morning and afternoon. Intervals of time appear to be set apart for him by naps and other outstanding events. Three-year-olds often confuse getting up from a nap with getting up in the morning. When such confusion occurs, they often demand to have done for them those things which ordinarily follow getting up in the morning. If a child has a regular routine which he follows in the morning and in the afternoon, as, for example, going to the park in the morning or going to the park in the afternoon, a change in the time of the routine activity will serve to make him mistaken in the time of day. For example, a child who had always been taken to the park in the afternoon, when taken in the morning, said, "When I go back, my Daddy will come home," since this was what occurred when he returned from his afternoon excursions. Gradually the longer intervals of time come to be separated into smaller intervals by such outstanding events as the meal, the bath, and the daily excursion; but it is not until the average child is six years of age that he is able to make such an obvious

* See also Harrison (13), Oakden and Sturt (21), and Schaefer (27).

distinction as that between morning and afternoon.* He tends to refer to events a day, a week, or some hours old as having occurred "yesterday" or "last week" or even "tomorrow." Freedman† finds the time concept vague to the sixth grade. The concept of a "long time ago" is much less clear than "a short time ago."

Perception of Number. The perception of number develops slowly. Though the infant knows, when he is playing with two objects and one is taken away, that something has occurred, a fact of which he will shortly make you aware, he does not have a clear perception of one and two. By the time he has reached the age of three, the average child can count two objects, and by the time he is four years of age, ability to count four objects can be expected. Ability to count four objects is one of the tests placed in Year IV of the Stanford revision of the Binet tests. Douglass (8) as a result of a series of tests for ability to estimate the number of objects in a group, where the objects consisted of groups of marbles and a number of dots plainly visible on a card that was exposed for a period just long enough to enable the dots to be seen but not to be counted, reached the following conclusion, which is quoted directly from his article:

> Children of this age (range, four years six months to six years of age) have completely accurate concepts of one and two, very serviceable and accurate concepts of three, and a very serviceable concept of four, and of five, six, seven, eight, nine, and ten rather vague concepts though serviceable to a slight degree.

Baldwin and Stecher (2) have conducted a number of experiments on the perception of number in children of pre-

* See Stanford Revision of the Binet Tests, Year VI, A1, test.

† See FRIEDMAN, K. C., "Time Concepts of Elementary School Children," *Elementary School Journal*, **44**: 337–342, 1945.

school age. In their laboratory the experiments were undertaken to determine the way in which a child analyzes "much and many." Three tests were given in all. Test 1 consisted in having the child match the number of white sticks on a green table by placing a similar number of sticks. The numbers of sticks to be matched occurred in the following order: three, six, four, nine, one, ten, two, five, seven, eight. "The age scores were 1 point at two years, 2.4 at three years, 4.7 at four years, 6.3 at five years, and 7.5 at six years." The second test consisted of asking the child how far he could count. The score was the highest number to which the child could count correctly without omissions or transpositions. "The scores on this counting without objects were 1 point at two years, 3.4 at three years, 10.6 at four years, 23.7 at five years, and 25.3 at six years." The third test given was counting marbles. On this test no score was made by two-year-olds; the score was only 2.1 at three years, but it increased to 9.2 at four, to 21.3 at five, and to 27.6 at six years.

Baldwin comes to the conclusion that counting objects is more difficult than counting without objects, a conclusion which would be in accord with the general consensus of opinion as to the development of number concepts. According to most authorities, the number names appear to come first, and the perception of the one-to-one relation between the number names and the objects in a series to develop somewhat later.

The Stanford Revision of the Binet test indicates several levels in the development in the perception of number. According to the 1916 revision a child of four should be able to count four pennies. At the age of six he should be able to count thirteen pennies, pointing accurately to each

penny as he counts. In the 1937 revision additional tests of number occur. At the age of five a child should be able to count three objects, pennies, beads, or blocks. Tests of number vocabulary occur at the age of six. Here the child should show his knowledge of the meaning of three, five, seven, nine, and ten, selecting each number of blocks from a group of twelve.

While this field needs further experimentation before final conclusions can be drawn, the perception of number apparently proceeds in a definite fashion. Children can say the words expressing number, *e.g.*, one, two, three four, five, six, seven, before they can count objects accurately. Even after they can count two objects they still say the number names sometimes up to ten or fifteen without any apparent recognition that these may be applied to objects. This behavior occurs at succeeding levels. A child of five asked to count thirteen pennies will often count in this fashion: he will count one, two, three, four, five, six, seven, eight, accurately and then rush through all the number names he knows before he reaches the thirteenth penny. Between the last object he counts accurately and the thirteenth penny he sometimes counts from eight to twenty-one, because, since these are all the number names he knows, he assumes that they must all be said before he reaches the end of the series of objects.

In our cases the number concept has appeared to develop in the following manner: (*a*) a few number names; (*b*) the application of number names to a short series correctly, while other number names are called inaccurately or without reference to the objects being counted; (*c*) further progress in the number of objects being counted accurately, while the behavior cited in (*b*) continues with objects

beyond the number correctly counted; (*d*) the use of numbers to indicate quantity as, "Bring me three blocks" or "Bring me two chairs"; and (*e*) the perception of number as indicating positions in a series. This would be expressed in terms of correct reactions to such commands as "Please bring me the third block," "Find the fifth little boy in the line."

Perceptions of Distance, Size, Form, and Direction. The young child acquires his perceptions of distance by a long process of trial-and-error learning. When the baby reaches at first, it is only in the most random fashion, and the object toward which he reaches is frequently not touched until a number of unsuccessful attempts have been made. He will reach as readily for bright objects at a distance, once he has fixated them, as he will for objects which are near at hand. He acquires correct perception of distance only after he has reached for countless objects and traversed areas either by walking, or by creeping, or by being carried over them.

Sonohara (29) found that two-year-olds were not able to see distance in abstract perceptive situations. He states that form perception really exists but correct perceptions of distance are not yet established. Observation of the behavior of children who reach for objects way beyond the length of their arms and of their failure to place objects accurately on tables or shelves bears out Sonohara's conclusion. In tests after the third birthday their objects are placed accurately; before this they are bumped too soundly or let fall before they have reached the surface.* Welch con-

* See also Irwin and Newland (14) for the attachment of correct names to visual figures and Welch and Long (36) for the discussion of the development of concept formation in children. Also see Jackson and Eckhardt (16) on multidimensional stimuli.

ducted a series of experiments on the development of size discrimination. As motivation for learning he put candy under one box. Three out of seventeen of his subjects were able to react to "middle-sizedness" in boxes when three boxes of different shapes were used. For these experiments Welch used twenty-five subjects between the ages of twelve and forty months.

Perceptions of size are also the result of a long process of development. The preschool-age child will attempt to hammer a large wagon, placed lengthwise across the door, through that space, when the wagon could easily be drawn through if it were facing in the other direction. Pushing or pulling large objects through doorways, fitting blocks in boxes, working with the Montessori insets and cylinders, and numberless other activities of a manipulative type are both interesting to the child of nursery-school age and valuable in furthering the knowledge of space relations.

Correct perception of form appears to develop relatively late. According to the standardization of the Stanford Revision of the Binet tests, ability to copy a square belongs in Year IV. Certain it is that two-year-olds make very ludicrous attempts to copy even so simple a form as this. Matching simple forms is also placed by Terman in Year IV.

Experimental material on the perception of form is neither great in quantity nor wide in scope. The work both of Baldwin and of Wellman on the Wallin pegboards in 1928 indicated that the perception of differences in the shape of the block increases in accuracy from the second to the sixth year. More recently researches have been conducted by Long and by Goodenough and Brian; the last, working with subjects from two years of age to adolescents,

used both form and color in matching a series of objects. The children were tested in accuracy in making discriminations in terms of form and color. This experiment threw further light on color discrimination in children, inasmuch as Brian and Goodenough found that children under three match for form and ignore color. Long, in his experiments, used spheres, cylinders, and a ball. His subjects ranged in age from three to six years. All showed some concept of roundness. Since a child of two according to the Kuhlman tests can draw a circle, it is safe to assume that correct concepts of roundness are present at two years of age.

The use of form boards serves to show how inadequate is the young child's perception of more complicated forms. Normal four-year-olds will often attempt to pound star-shaped blocks into spaces which are cut to fit triangles, and to make the same sort of futile attempts with the Maltese cross in the space meant to fit the star. Ability to copy even so simple a form as the diamond is one of the six tests in the seventh year of the Stanford revision of the Binet test. Playing with the various-shaped blocks and beads, kindergarten gift materials, the Montessori long stair, the broad stair, and the Montessori insets is excellent for the development of a sense of form. Drawing objects, activities in the sand pile with tin dishes and the other objects which make up sand-pile play, and modeling in clay are also excellent activities.

The nursery-school-age child is not well oriented as to direction. Even the ability to tell the right hand from the left is beyond him. Parents frequently make the mistake of insisting that the three-year-old extend his right hand, a command which he is unable to follow, because of his inability to distinguish rightness and leftness at this age,

unless a special effort has been made to select this hand by placing rings, bracelets, or other identifying objects upon it, and then teaching the child that "right" means the hand so marked.

Perception of Weight. It is difficult to measure perception of weight, inasmuch as language comprehension enters in to such a large extent that it is difficult to decide whether the child is making a mistake because he does not perceive that one weight is heavier than another, or because he does not comprehend what is meant by "lighter" or "heavier." Baldwin (2) has experimented on the ability to estimate weights. The objects used were boxes filled with shot. The boxes weighed respectively 3, 6, 9, 12, 15, and 24 grams. Two of the boxes used were empty. The children were first taught what was meant by "heavy" and "light." They were then given the test boxes in the following combinations: 3 and 24 grams, 3 and 15 grams, 3 and 12 grams, 3 and 9 grams, and 3 and 6 grams. Every member of the group was able to distinguish between 3 and 24 grams. The younger children in the group began to be confused when asked to discriminate between 3 and 15 grams. Terman places ability to distinguish between 3- and 15-gram weights at Year V in the Stanford Revision. The lack of ability to discriminate between the 3-gram and the 15-gram weights, shown by the children used in Baldwin's experiment, is indicative of an apparent lack of ability to determine which of the two weights was the heavier, since the children understood the meaning of the terms "heavy" and "light." Much more experimentation is needed to determine the development of children's perceptions in all of the special fields, that is to say, perception of time, size, form, distance, direction, weight, and number.

Perception of Rhythm. Since rhythm appears to be dependent upon a well-established control of the skeletal muscles, it is natural that the nursery-school-age child, particularly the child under three, should have great difficulty in engaging in rhythmical activities. His skipping to music is prone to be of the "one-foot variety," and to bear little relation to the time which the music itself maintains. Beating time by clapping the hands or by swinging the arms is likely to show equally little relation to the music which is being played. Baldwin conducted an experiment to measure the degree to which a child can keep time, by clapping two blocks together, and found that two three-year-old children made excellent records. From the observation of the writer, the two children cited in Baldwin's experiment would appear to be somewhat unusual. No statement is made as to the extent to which the sense of rhythm differed on the part of his younger and older groups.

Growth of Perception. The perceptions of the child change by analysis and by synthesis. They change by analysis in that he does not perceive qualities which are inherent in objects and situations until he has perceived those same qualities in dissimilar objects and situations. If a child never saw the color yellow except in a ribbon, he would perceive that as inherent in ribbon, and not as a separate quality. What actually happens is that he sees yellow in a flower and in lights; he sees yellow paper, yellow dresses, yellow shoes, and so on. After a number of such experiences, he perceives the color quality as a thing in itself. Similarly he perceives four clearly only after he has seen four pennies, four trees, four tables, four chairs. Part of the education of a child in the preschool period is training

in just such analysis of qualities. He is told to bring four spoons, four forks, and four knives, and these are given him by someone in the correct proportion if he cannot count. He counts insofar as possible the blocks which go into his building, the steps in the nursery, the chairs, and so on until by the age of five he has developed fairly usable concepts of numbers up to between six and thirteen. Training in the perception of certain qualities makes them much more easily perceived. For example, by this process of analysis the child who has received education and training can see other colors in objects which to the untrained eye appear uniform. The purple which appears in the shadows on the trunks of pine trees is seen only by the trained observer; to the untrained eye the whole trunk appears to be a uniform brown.

Perceptions grow by synthesis in that new qualities are continually being subsumed in categories under which they were not originally put. One begins by perceiving honesty only as telling the truth in a rudimentary way and not concealing things. Later one perceives honesty as fair dealing with other people, keeping promises, and innumerable other things. The number of things which one perceives as a part of this and other concepts depends wholly upon the experiences through which one has passed. One perceives ordinary coal as carbon, but training in chemistry will lead to one's classifying the diamond and other dissimilar objects under a common heading.

Biological Significance of Perception. Perception seems to have two functions in the life of the individual: (*a*) to give knowledge and (*b*) to govern reactions. As the child sees, hears, feels, and otherwise experiences objects and situations, his knowledge of them grows. The more experiences

which he has with tables of different kinds, the wider is his knowledge of those objects. He first perceives tables as things upon which to eat; but later experience may add to his perceptions to such an extent that he may perceive tables in relation to the laboratory, the operating room, the conference group, or tables as mere decorative articles of furniture.

Perception as Governing Reaction. The knowledge which the individual has of the object or situation presented determines his reaction. To use Judd's (18) illustration, if one says to the average individual, "Here comes an ornithorhynchus paradoxus," he is unable to govern his behavior rationally. He does not know whether it is an object from which he must run, whether it is an interesting object which he must approach, or whether it is a thing which is of no interest to him and which he can therefore afford to ignore. It does not help his problem further if one says, "Here comes a duckbilled platypus." He hears the words, but his previous sensory and perceptual experience has given him no knowledge of how to react to situations similar to this one. This inability to govern a situation because of lack of knowledge of the meaning of words is constantly occurring in the life of children. It is also a constant part of adult social experience. A strike which occurs in an industry may be the direct result of inability to perceive clearly on the part of both the managers of the industry and the strikers themselves. Reduction in wages, which may be simply the result of overproduction, may be seen by the workers as an attempt on the part of the management to make more money than is legitimate. The workers' protest may be conceived by the management as an attempt to enforce demands which, if granted, would

cripple the industry for a prolonged period. An economist, perceiving the same situation, would probably interpret it in terms of the law of supply and demand, and would, therefore, be able to make an adjustment which might satisfy both of the contending parties. Boards of arbitration seem to be established for much this purpose, *i.e.*, to bring all points of view to bear upon a situation so that it may be perceived in its correct relations.

With a child, as with an adult, the extent to which reactions are governed correctly will depend largely upon the extent to which his previous experience has been rich, wide, and varied. Education has as one of its functions giving knowledge which will enable a child to perceive things in their correct relations and, therefore, to react to them in line with the best interests of both the individual and society.

EXERCISE

Observe the behavior of a group of young children.

How much does sensory play have a part in their games and occupations?

Compare the behavior of the group studied with that of your subject.

What interest do they show in gaining new sensations?

List the reactions of a child with a new toy. Draw conclusions as to the number of sensory experiences which the child received.

Show an ink blot to a young child and ask him to name it.

Show a picture containing common objects to a young child and ask him to tell you about it. How far does he name the objects correctly?

Ask the child what time of day it is at four or five different intervals. Note his responses.

Ask him to give you the date of his birthday and to tell you how many weeks or months have elapsed since his birthday.

Show a child under four years of age a number of objects and ask him to count them. Note his responses.

Ask the child to name the colors of the clothes which he is wearing.

Show a card containing such simple forms as a circle, a square, and a Maltese cross. Ask the four-year-old to copy these for you.

On the basis of your observations, draw conclusions as to

A. The interest of the child in sensory experience

B. The use of toys and play materials in developing perception

C. The child's perception of number

D. The child's perception of time

E. The child's perception of shape and size

Bibliography

1. Arlitt, Ada Hart, and Sophie Harrison Buckner: "A Study of Color Preferences in White and Negro Children," Proceedings of the Thirty-fifth Annual Meeting of the American Psychological Association, pp. 190–191, Philadelphia, December, 1926.
2. Baldwin, Bird T., and Lorle Stecher: "Psychology of the Preschool Child," Chaps. VI, VII, pp. 123–130, D. Appleton-Century Company, Inc., New York, 1924.
3. Beasley, W. C.: "An Investigation of Related Problems in the Vision of Newborn Infants, *Psychological Bulletin*, **30**: 626.
4. Carr, H. A.: "Psychology: A Study of Mental Activity," Chap. VI, Longmans, Green and Company, New York, 1925.
5. Colvin, S. S.: "The Learning Process," Chaps. V, VI, The Macmillan Company, New York, 1917.
6. Cook, W. M.: "Ability of Children in Color Discrimination," *Child Development*, **2**: 303–320, 1931.
7. Dashiell, J. F.: "Children's Sense of Harmonies and Tones," *Journal of Experimental Psychology*, **2**: 466–475, 1917.
8. Douglass, Harl R.: "The Development of Number Concept in Children of Pre-school and Kindergarten Ages," *Journal of Experimental Psychology*, **8**: 467, 1925.
9. Elkin, E. D.: "De l'Orientation de l'enfant d'age scolaire dans les relations temporelles," *Journal de psychologie*, **25**: 425–429, 1928.
10. Fenton, Jessie C.: "A Practical Psychology of Babyhood," Chap. III, Houghton Mifflin Company, Boston, 1925.
11. Goodenough, F. L. and M. A. Tinker: "A comparative study of several methods of measuring speed of tapping in children and adults," *Journal of Genetic Psychology*, **38**: 146–160, 1930.

12. Hall, G. S.: "Aspects of Child Life and Education," p. 24, Ginn and Company, Boston, 1907.

13. Harrison, M. L.: "Nature and Development of Concepts of Time among Young Children," *Elementary School Journal*, **34**: 507–514, 1934.

14. Irwin, F. W., and E. A. Newland: "Genetic Study of the Naming of Visual Figures," *Journal of Psychology*, **9**: 3–16, 1940.

15. Irwin, O. C. and A. R. Weiss: "A Note on Mass Activity in Newborn Infants," *Journal of Genetic Psychology*, **38**: 20–23, 1930.

16. Jackson, T. A., and M. E. Eckhardt: "Studies in the Transposition of Learning by Children: V. The Number of Stimuli in the Training Series as a Factor in Generalization," *Journal of Experimental Psychology*, **27**: 303–312, 1940.

17. Jersild, Arthur T.: "Child Psychology," Prentice-Hall, Inc., New York, 1940.

18. Judd, C. H.: "Genetic Psychology," D. Appleton-Century Company, Inc., New York, 1903.

19. Ling, Bing-Chung: "A Genetic Study of Sustained Visual Fixation and Associated Behavior in the Human Infant from Birth to Six Months," *Journal of Genetic Psychology*, **61** (II): 227*ff*.

20. Luken, E. M.: "Color Discrimination in Young Children," University of Cincinnati, 1933.

21. Oakden, E. C., and M. Sturt: "Development of the Knowledge of Time in Children," *British Journal of Psychology*, **12**: 309–336, 1922.

22. Pratt, K. C.: "The Neonate," in Carl Murchison, editor, "A Handbook of Child Psychology," 2d rev. ed., Chap. III, pp. 163–208, Clark University Press, Worcester, 1933.

23. Ransohoff, M.: "A Study of Imagination in Young Children," Master's Thesis in the Library of the University of Cincinnati.

24. Rasmussen, Vilhelm: "Child Psychology," Vol. I, Chap. V; Vol. II, Chap. II, Alfred A Knopf, New York, 1923.

25. Rebello, S.: Pesquiza sobra a nocado de tempo (Study of the Notion of Time), *Bol. Educ.*, **4**: 134–182, Pernambuco, 1934.

26. Rust, M. M. (ed. A. T. Jersild): "The Growth of Children's Concepts of Time, Space, and Magnitude," unpublished, Teachers College. Columbia University, New York.

27. Schaeffer, C.: "An Informational Unit on Time," *Elementary School Journal*, **38**: 114–117, 1937.

28. Shinn, M. W.: "Notes on the Development of a Child," Vol. II, pp. 148–172, Berkeley University Press, 1907.

29. Sonohara, T.: "Distance Perception in a Two Year Old Child," *Japanese Journal of Experimental Psychology*, **5**: 149–172, 1939.

30. Staples, R.: "The Responses of Infants to Color," *Journal of Experimental Psychology*, **15**: 119–141, 1932.

31. Tanner, Amy Eliza: "The Child," pp. 124–125, Rand McNally & Company, Chicago, 1904.

32. Updegraff, R.: The Visual Perception of Distance in Young Children and Adults: A Comparative Study," *University of Iowa Studies in Child Welfare*, Vol. IV, No. 4, 1930.

33. Updegraff, R., L. Heiliger, and J. Learned: "The Effect of Training Upon the Singing Ability and Musical Interest of Three, Four, and Five-Year-Old Children," Part III, "Studies in Pre-school Education," *University of Iowa Studies in Child Welfare*, New Series, No. 346, I. **14**: 83–131, 1938.

34. Updegraff, R., *et al.*: "Studies in Pre-school Education I," *University of Iowa Studies in Child Welfare*, new series, No. 346, **14**: 85–131, 1938.

35. Wellman, B.: "Development of motor coordination of young children," *University of Iowa Studies in Child Welfare*, **3** (4): 1–93, 1926.

36. Welch, L., and L. Long: "The Higher Structural Phases of Concept Formation of Children," *Journal of Psychology*, **9**: 59–95, 1940.

37. White, R.: "The Space Order Reaction of Young Children," *Child Development*, **2**: 75, 1931.

Chapter - - - - - - - - - - - - - - - - - Ten

MEMORY

MEMORY, IN THE SENSE IN WHICH IT IS HERE USED, signifies both the changes which occur in infants and children as a result of contact with their environments and the conscious correlate of such changes. The term in its broad sense refers to anything learned, including those phenomena classified under the heading of physiological memory, habits, and so on. Memory in its restricted sense refers to that portion of the conscious life which deals with ideas, images, and concepts. In our treatment we propose to use the term in its broadest sense. From earliest infancy impressions are being received which will affect much of the infant's later behavior. Though these impressions will probably never be recalled with any degree of definiteness, each new experience will be reacted to in terms of them.

Long before the memory process is functioning in such a way as to be used adequately and measured accurately, impressions are being made. While the child may not recall the source of these impressions at any time in later life, they are nevertheless there and functioning to produce attitudes of withdrawal or the reverse. It is highly probable that some of the prejudices which function so strongly in later life have their basis in impressions made while the

child was still an infant in arms. It is not necessary to depend upon theoretical considerations in making these statements inasmuch as there is both observation and experimentation to prove these points. It is only necessary to refer to the early literature on memory to find descriptions of the behavior of individuals who were able to recall in delirium or during illness experiences which they could not recall when functioning normally, and also to such experiments as Burtt's (7). Burtt read passages from Sophocles to a boy fifteen months old. He read twenty lines in the original Greek every day for a three months' period. When the first three months had elapsed he repeated the procedure with twenty new lines. This was continued until his subject reached the age of three.

At eight years and six months the subject was required to memorize the same lines. In addition he was required to memorize new material from Sophocles. The boy took 435 repetitions to learn the new material but lines previously presented were memorized in an average of 317 repetitions. This procedure was repeated when the subject reached the age of fourteen. At this time Burtt found that there was still some difference in favor of the lines heard before the age of three but the difference between the rate of learning these and learning new lines was less than at the age of eight years and six months. Since no learning of Greek had occurred in the interval it is obvious that material read to the child before he could comprehend its meaning in any way nevertheless remained a part of his memory content and modified later experience.

Gordon (16) indicates that individuals do not recall clearly anything which has occurred before the third birthday. Such memories as are present appear to be dis-

proportionately of punishments and other unpleasant occurrences. Blonsky (4) also found that a large proportion of early childhood memories were of such things as death, pain, and punishment. Apparently there is a higher degree of intensity in unpleasant than in pleasant experiences, where the experience has a very high degree of intensity and the recall is delayed for a long period. Pleasant memories, however, do tend to be recalled more easily under ordinary learning conditions.

Verses dramatized, and verses which deal with interesting experiences which the child himself has had, are mastered much more readily than those which deal with unfamiliar experiences and those which do not involve the dramatic element. A single trip to an amusement park will result in a store of memories which may be kept over a long period. The child who has such an experience once will often, on his return to the park, demand to be taken to the same merry-go-round or to some other spot which has furnished a delightful experience on the previous occasion, though no mention of the spot has been made by the adult who accompanies him.

Experiments on Intrauterine Development. No chapter on infant memory would be complete without a description of the recent work of Gesell (15) on the embryo and the fetus. The study was made on a series of embryos and fetuses removed while living and a series of films of embryological and fetal behavior. Beginning with the fourth week of life, the embryo shows a clear pattern of behavior. At this stage the pattern is restricted to heartbeat and some blood-vessel development. The embryo is approaching the fetal stage, when overt movements can be expected to appear. It is probable that slightly previous to this time the

first twitch of the heart has appeared. Gesell points out that it may be a single twitch. This is followed by a brief rhythm, and, finally, by nine and a half weeks, the heart has set its pace. An electrocardiogram taken at this age shows the main features present at maturity, *i.e.*, the main features present in the adult. It is probable that the pattern taken by the heart during its stages of maturation is the same as that which Coghill has shown in Amblystoma and which has been demonstrated by Hoff and his associates in the chick. The overt muscle patterns appear to develop shortly after. After the eighth week, when the fetus begins to acquire ears, face, mouth, eyes, legs, and arms and the cortical cells appear, stimulation produces reflex movements in the head and arm region when the cheek is tickled with a hair. The pattern of the hand and foot is fairly complete.

The nervous system becomes much more elaborate toward the end of the twelfth week, and by the fourteenth week the fetus is able to respond in an integrated pattern to tickling: the head is raised, the back is arched, the trunk is rotated, and the mouth opens when the stimulus is applied to the back region. The blink reflex is present by the sixteenth week. The upper, then the lower, lip moves; the fetus can swallow, move its tongue, and clench its fist. From the sixteenth week to the twenty-fourth patterns are acquired rapidly. To the reflexes listed before can be added hiccuping and wailing. By the twenty-eighth week the infant has a good chance of survival if born prematurely. It has now added most of the pattern reflexes which it will possess at birth, *viz.*, yawning, sucking, wailing, or bleating. By the thirty-sixth week the infant reacts to hunger with a cry, wakes and sleeps naturally, and reacts positively to stroking, petting, and otherwise

being handled. The attitudinal reflex, *e.g.*, the head-neck-arm pattern which is studied later in ring behavior, is already well developed by the twelfth to the sixteenth week. Since motor attitudes are an important part of behavior and even of thought, it is interesting to note that attitudes are present in these early stages of development. Even by the sixteenth week the fetus shows a considerable amount of free head movement and a corresponding amount of arm and leg movement. It is interesting to note that there is leg movement present, inasmuch as after birth the predominant motion is from the chest through the head region. Any observer can note the preponderance of arm, fist, neck, head, and facial motion over leg. This is probably also true of intrauterine behavior. Integrated bilateral behavior patterns which underlie later adjustments are therefore present long before birth. Also, they are present in a maturational series predictable within relatively narrow limits. There are tremendous individual differences in the degree of maturity at birth and therefore in the prepotence of specific learning patterns. One infant may be forty weeks old when born, whereas another may lag behind fourteen weeks in his developmental pattern. The old idea that all individuals are equal at birth, if it ever had any credence, would certainly be buried under the mass of data presented by Gesell's book.

The behavior at the fortieth week has already been described, since this is the normal birth date for the average child. The importance of these behavior sequences for the later life of the child can hardly be overestimated. There is little question that if the infant is responding to stimuli—and Gesell's work indicates clearly that it does so respond—

conditioning may and undoubtedly does take place any time after the eighth week of life. What this conditioning is, and how it is done, is still somewhat open to question, but further researches along the same line as those of Gesell will no doubt throw clear light on this heretofore relatively unexplored area of human behavior.

Memory in Infancy. The memory process in the infant, although far from comparable with the same process in the child of three or even in the child of one year of age, is yet functioning from birth. It is probably more in the nature of physiological memory in the first few weeks of the child's life, whereas the memory process of the older child is of a somewhat different nature.

From the time the child first receives sensations of contact, temperature, pain, and taste, he begins to interpret, vaguely, of course, similar sensations as they reach consciousness. His total conscious process can be described in terms of James's phrase: "As a blooming, buzzing confusion." Out of this confusion several groups of sensations have begun to be selected by the end of the first few months. The face of the mother, constantly associated with an increase in comfort or with the cessation of pain or discomfort, is soon recognized and selected out from the great mass of stimuli constantly impinging upon the infant's consciousness.

The infant's attention is attracted by whatever is going on. He attends first to this and then to that strange stimulus, and from each thing, as he attends to it, he receives groups of stimuli which, like the face of the mother, will later come to be recognized as objects having definite and clear characteristics of their own.

Observations of Memory in Children. A great mass of data dealing with the memory of young children is observational in nature; in other words, it is a record, or a series of records, made of the performance of an individual child. For example, Stern (35) states that Scupin's son recognized familiar faces at 3 meters' distance at the age of three and a half months. At the same age strangers were known as such and considered with a serious look of astonishment. Stern also recorded that his daughter Eva recognized the difference between strangers and the mother at the age of four and a half months. Stanley Hall records a distinct feeling of familiarity when he returned as an adult to a farm which he had left at the age of one and a half years. Preyer's baby (27) recognized his father's image in the mirror in the twenty-fourth week; in the fifty-seventh and fifty-eighth weeks, Preyer's boy, looking at his image in the mirror and at a picture of himself, apparently recognized both. In the sixtieth week, the same baby appeared to recognize his mother's image as different from the reality. The work of Watson (41) gives ample evidence of the memory for objects to which fear has been attached by direct conditioning, even when such conditioning has been done at an early age. An instance which came under our own observation of such memory in a very young baby, probably wholly physiological in type, occurred in the case of a baby who, two days after birth, had drops put into its eyes. For at least twenty-four hours after the drops had been placed in the baby's eyes, he would not keep his eyes open for longer than it took to open and close them. There appeared to be some association between the light rays as they struck the eye and the unpleasant sensations which had accompanied the opening of the eyes when the drops were placed in them.

In spite of the fact that impressions do begin to register immediately after birth, and that there is evidence that the memory process is functioning in a crude way from earliest infancy, it is doubtful whether the child can recall, by the time he reaches the period of school age, experiences which have occurred during the first year and a half of his life.

Stern (35) gives the following instances of memory in young children: Scupin's son, at the age of one year, had once seen bacon fried, and seeing an onion put into the pan, had called the onion a ball. Two weeks later when bacon was fried again, the child cried, "Da, mama, ball, bah." Deville states of his daughter, one year six months of age:

> She has a succession of catalogued facts in her memory which she remembers every day at their special hour and at no other. She is barely awake before she demands her bath; from 9 to 10 A.M. she asks for her hat and talks of her walk, the basket to be taken, and the newspapers to be put in it. Breakfast is scarcely over before she asks for the coffee pot to carry it into the kitchen, and all this happens without anything being said or done to rouse her remembrance.

Gunther, at the age of one year and eleven months, heard his sister Hilda mention the word "board." He pointed at once to the easel board and said, "Wow-wow." At the time there was no dog to be seen on the board, but two and a half months previous to this time, Gunther's mother had drawn large heads of a dog, a horse, and a cat on the board, and the child had been particularly delighted with the drawings. As a check in determining whether Gunther had really remembered, his mother asked, "And what else did you see on the board?" The baby replied, "Gee-gee."

In summing up the significance of these instances, however, Stern makes the following statement:

> Nevertheless, such remembrance is so rare, even in the third year, that it immediately arouses the observer's attention. As a rule, for the child of that age, it is still "out of sight, out of mind," and it seems remarkable sometimes how little he notices or feels the absence of persons or things that have formed part of his ordinary environment. It needs but little to revive his remembrance of them, but he never really misses them.

Stages of Memory. The memory process may be divided into four stages: (*a*) impression, (*b*) retention, (*c*) recall, and (*d*) recognition. Impression means the reception of the stimuli by the receiving organs and their nervous connections. Retention is physiological. It implies simply the retention of such impressions in the form of traces of some sort in the nervous system. Recall implies the revival of past experiences, and recognition involves placing such experiences in the time and place in which they occurred previously.

The impressions which children receive differ from those of adults in many ways. Insofar as the memory process involves elements of time, number, the correct perception of shape, size, direction, and distance, the preschool-age child is definitely handicapped. Since, according to the test results, the average child is not able to copy a square in pencil until the age of four, it is highly improbable that any clear impression of shape is received. Material, therefore, is not remembered in the form in which it actually occurs. Children's drawings give ample evidence on this point. Orientation in time, as has been stated in the chapter on perception, is also extremely vague. The child differentiates between night and day, but until he reaches

approximately the age of six, he is unable to tell whether it is morning or afternoon. It is to be remembered, therefore, that when he remembers events he does not place them correctly in time. He will state that he went for a walk yesterday, and what he may mean is that he went for a walk an hour ago. Past time may be called "yesterday," or, as was the case with one three-year-old child, "next week." In addition to these handicaps in the functioning of the memory process, there is the difficulty that has been pointed out previously, with the memory of anything that involves word forms. It is a relatively simple matter for the adult to remember, in terms of connected sentences, exactly what he did on a previous occasion. With the child, such memory must be largely in terms of concrete images.

Memory span, impression with immediate recall, appears to be influenced in childhood by the same factors which influence retention and recall in later life, namely the type of material used, the rhythmic or nonrhythmic presentation of material, the sensory channels through which the impressions came, the degree to which destruction is present, the general mental set of the subject, and the subject's age. Binet and Simon (3) stated that rhythmical presentation is better than nonrhythmical and this is borne out by other experimenters. It is also the result of common experience that children learn for later recall more easily when the material is presented in verse than in prose form. Rhythmic presentation is in its essence presentation in groups. Whitley (42) and Chamberlain (9) both demonstrated that recall is better when material is grouped.

Fatigue plays a large part in the speed of impression and in recall, though Smedley (32) states that the fatigue

factor is difficult to test, since practice increases the speed impression almost as rapidly as fatigue tends to interfere with the process. The influence of the sense avenue used in receiving impressions appears to be great.

The time of day also appears to affect the speed with which the impression is received and the ease of recall. Experiments on children under five years of age are too limited in scope to enable us to draw final conclusions about these factors in the preschool period. However, since they appear to influence memory, both as to speed of impression and as to the degree to which the material may be recalled after periods of varying length in individuals from early school age through college, these factors would also appear to play an important part from infancy to five years of age.

Children's imagery, like the imagery of adults, probably involves all forms of material mediated by the end organs of sensation, and such images, instead of being recalled only partially, are probably recalled in their totality. The recall of the adult is always partial in that he drops out irrelevant instances and all material which does not bear upon the points of what he is thinking, or the situation in which he is reacting, whereas the young child probably recalls the sequence of events in the main in the order in which they made their impression upon him. The recall is partial chiefly in the sense that many of the stimuli which are impinging upon him at any time are not attended to, largely because his experience does not allow him to select them and react upon them.

The experiments of Thorndike (39) indicate that recall in preschool-age children is exceedingly poor. In fact, in order to have as poor a memory as a child under five the

adult has to reach a stage of relatively advanced senescence. This is probably due not to the actual retention of impressions in the nervous system but to difficulty in recall.

In order to build material to the level of easy recall it is necessary for children to repeat a performance many more times than is required in adult learning. Explanations for this are relatively simple to find, but one may be the fact that the child has very few associations to aid in recall where the adult has many.

Many repetitions are a characteristic of infant and childhood learning. Observation of an average child will give an infinite number of illustrations of repetition to a point which would be impossible at adolescence or when the individual has become an adult. The writer observed one six-year-old girl attempting to learn to spin a top. Every afternoon for six weeks for a period of from one to two hours A wound the top and threw it. A three-and-a-half-year-old in the University of Cincinnati Nursery School rode a tricycle every day in three months for the entire period of outdoor play. The only variation in this activity was that sometimes he tied a wagon in the rear of the tricycle and sometimes he rode it with nothing tied to it.

Children learning to talk repeat the same series of syllables over and over until the listening adult is tired of the sound. Anyone who has told stories to young children will find that children, far from resisting an infinite number of repetitions, enjoy most those that carry a repetitive phrase or the repeating over and over again of a series of words or descriptions of activities. That the brain is more plastic in infancy than in later life has been demonstrated too often to make it possible that the factor of plasticity

accounts for the number of repetitions necessary to master a word, a phrase, a verse, or an activity.

Retention is probably at least as good in children as in adults. It is doubtful whether any impression once made is ever totally lost, but children may never be able to recall such impressions or to place them as part of previous experience if they are recalled. Many experiences which cannot be recalled and recognized may nevertheless condition later reactions. Likes and dislikes of particular people and places, many superstitions, and numerous other reactions are based on experiences, the key to which has long since been lost.

Children find it difficult to recall and recognize objects even when their experience with them has been relatively recent or long continued. Stern (35) states of Scupin's son the fact that, though the baby had played with a rabbit to which he was devoted from the age of two years two months to the age of two years eleven months, at four years eight and a half months he failed to recognize the animal in a picture showing the rabbit and the child together. The boy insisted upon knowing why his picture had been taken with the rabbit and where the rabbit had come from.

Errors in the recollection of children are very numerous. A slight suggestion on the part of an adult who is questioning the child will often serve to make the child feel that he has had the experience. Children will describe in detail experiences which they have been told that they will have, though the experiences themselves have not occurred. Stern cites numerous instances on this point. The following are quoted directly from Stern's book, "Psychology of Early Childhood."

In the case of Hilde, aged three years and ten months:

In February, when we were going for a walk in the park, I talked to Hilde a good deal about the swans on the lake there, and we both wondered if we should see them. But no swans were out, as the water was covered with a thin coating of ice. We talked some time as to whether they were in the water under the little swan house, and what it might look like inside there. As we went home we talked of other things, and I asked Hilde, "What will you tell Father?"

She promptly answered, "That we saw the swans."

I: "What did we see?"

Hilde: "Lots of swans."

I: "Did we really see swans, Hilde?"

Hilde (thoughtfully): "No, they were inside the little house."

In the case of Eva, aged four years and ten months:

I went with the children to a dairy with the expressed intention of buying milk cheese which they all liked. But there was none to be had, and instead I bought some pickled cucumbers. Half an hour later Eva told her father, "Today with mother we bought some milk cheese." Gunther contradicted this, and Eva corrected herself with, "Oh no, pickled cucumbers." To her father's astonished question as to whether these were much the same thing she explained, "No, but we wanted to buy some milk cheese."

Because of this tendency of children to react to suggestions, it is unwise to question them too closely in regard to an experience that the adult is not sure that the child has had. Such a question as "Tell me what you saw on your way to school; I am sure you saw something very interesting," may bring out a story which often is beyond the wildest imaginings of the adult.

The great suggestibility of the child is responsible for much of what passes for children's lying. The examples

cited from Stern give instance of what would popularly be termed lying, where the mental processes of the child observed were not clearly understood by the observer who recorded the instances. Other errors in the recollections of children arise from the false perceptions of distance, time, number, and direction, cited earlier in the discussion of memory.

Further data as to the memory process in young children come from (*a*) experiments with preschool-age groups and (*b*) mental-test results.

Experiments with Preschool-age Children and Animals. Experiments on memory in preschool children can be classified under three heads: (*a*) those on the delayed reaction; (*b*) learning and retention of different types of material; (*c*) mental-test results.

Delayed Reactions. The first experiments in this field were conducted by Hunter (21) with animals and children, comparing the animals used, two rats, a dog, and a raccoon, with children aged two and a half, six, and eight years of age. The apparatus used was a box in which the animal or child stood until released and three doors over which appeared lights which indicated the presence of a reward. The subjects were first trained to react positively to a light over the door which led to the reward. After they had been trained they were placed in the compartment. A light was shown over the door behind which was the reward. It was then switched off. After periods of varying lengths the animal or child was released and allowed to go toward the door behind which the reward was to be found. The maximum delay after which a correct response could be made was noted for each subject, together with all

correct and incorrect responses. The maximum delay for rat I was 10 seconds, for rat II was 1 second, for the dog 5 minutes, and for the raccoon 30 to 35 seconds. A part at least of the difference between the dog and the other animals can be explained in terms of orientation to the stimulus, since Walton (40) has shown that 30 seconds is the maximum delay for dogs when they are distracted during the interval.

The youngest child has a maximal delay of 50 seconds. Even after 507 trials, F could not make successful choices after a delay as long as 1 minute. These results indicate that though memory was present at the age of two and a half, F could remember only for as long as 50 seconds. M, eight years of age, Hd, L, and H, six years of age, could remember for 25 minutes.

Hunter repeated this experiment with his daughter Thayer when she was from thirteen to sixteen months of age. The apparatus used consisted of three boxes placed on a stand 6 inches in height. The stimulus objects used were dolls, games, small books, rattles, shoe buttoners, and so on. She was first handed the stimulus object; it was then taken away from her and put in one of the three boxes. Her attention was then distracted by (*a*) the experimenter placing his hands over her eyes; (*b*) she was stood up and turned with her back to the apparatus; (*c*) the experimenter spoke to her, thus causing her to turn her head. Thayer's best delays were from 20 to 24 seconds.

From the results of these experiments we can conclude that memory, even immediate memory, at the age of two and a half is very poor. At between thirteen to sixteen months of age immediate memory is not quite on a par with that of the dog or raccoon.

The importance of these results to the interpretation of child behavior can hardly be overestimated. It has long been known that punishment must follow immediately if it is to be effective with children under five and that to delay such punishment for from 3 to 5 minutes attaches it not to the undesirable activity but to whatever immediately preceded the punishment. Since it appears that very young children forget even a situation involving a stimulus of great interest within 20 to 50 seconds, it is obvious that a delay of 2 to 3 minutes results in the forgetting of the less interesting situations. It must be remembered too that Hunter's subjects were trained to react to the specific situations involved and therefore should have remembered these longer than they would situations which occurred infrequently.

Hetzer and Tudor-Hart (19) experiments are not quite in line with these results, since they reported that at seventy-five months children show recognition of an object after an interval of as much as 5 minutes, while at two years they show recognition of an object after an interval of 20 minutes. These results are open to question, inasmuch as children are muscle readers in the same sense as are animals. Changes in the facial expressions of the experimenters and in their muscular sets or in eye movements would be sufficient to yield these results. Cues given by these experimenters to their subjects were not checked. Skalet's (30) experiments with cookies as the stimulus yielded somewhat more significant results. Her subjects were between the ages of two and five and a half years of age. These children could delay one to three days and still have a proportion of correct responses when asked to find the cookies. We have already called attention to

the fact that subjects usually tend to retain and recall more easily situations and attitudes associated with pleasant results. These experiments add further support to this point of view. High intensity of a pleasant nature appears to produce a large proportion of correct responses after a long delay, while less intense rewards do not enable the subject to make correct responses after as much as 60 seconds' delay (22).

Experiments on Memory for Different Types of Material. Experiments by Baldwin and Stecher (2) at the State University of Iowa yield interesting results as to the memory of children two and over for certain kinds of objects. Baldwin experimented with visual memory in terms of ability to remember series of taps in a prescribed order (Knox cube test). In this test, four black cubes separated by equal spaces are tapped with a fifth cube in the prescribed order demonstrated by the experimenter. The test was given by Pintner's standard procedure. A score of 1 was given for each line successfully imitated. The younger children merely tapped the blocks, or played such games with them as "train" or "bridges." The age averages were less than a single line repeated correctly at ages two and three. At four years the average was 1.41; at five and six years, the average was 4.3 lines.

The second test was one of ability to remember objects in pictures. For this test a practice card, five stimulus cards, and a memory chart were used. One, two, three, four, or five pictures were pasted on cards 8 by 5 inches in size. On one card were five rows of ten pictures. The pictures were black-and-white outline drawings of common objects. The children sat before a table on which lay the memory chart folded in half. The experimenter showed a practice

card for 5 seconds, saying, "Look at this very carefully." At the end of the time the practice card was taken away, the memory chart opened, and the child told to find the same picture that had just been shown to him. If the child did not succeed in finding the picture in 2 minutes, the practice card was shown again and the search was continued. After the object on the practice card was found, the experimenter showed the child the first test card for 5 seconds and allowed him to hunt for the object on the memory chart. The second card was shown, containing two objects. This was exposed 10 seconds. This procedure was followed for the remaining cards. Fifteen seconds were allowed for three pictures; twenty, for four pictures, and so on. A score of 1 "was given for each picture remembered," whether presented alone or with others on the same card. The age score showed an average of less than one picture remembered by the two-year-olds, but the increase at the later ages amounted to 4.5, 8, and 11.1. At six years the average score was still only 11.5. The adaptation board was also used by Baldwin, who states that it "depends to some extent upon the development of special perceptions and upon visual and kinesthetic memory." As this test is one well known, it is useless to describe the procedure here in detail. The average memory is a little more than one move at two and three years. At four years it increases to 2.1, at five years to 2.9, and at six years the average score is 3.3.

Baldwin uses another test of memory which is not classified under the same heading as the ones described above, but it is obviously a test of ability to recall and to act on the basis of such recall: A chain of beads was shown to some of the older children in the group, with a

time exposure of 10 seconds. The children were told, "I am going to show you a chain of beads. I am going to show it to you for only 10 seconds and then I am going to take it away again. Be sure to look at it carefully, because 10 seconds is a very short time, and after I take it away, I am going to ask you to make one just like it." The age scores for the rhythmical memory chain were 5.6 points at age three, 14.3 at age four, 16.5 at age five, and 16.3 at age six. An unrhythmical chain was done somewhat better than the one with design.

Material Derived from Test Sources. Many of the tests contained in the Kuhlman revision of the Binet-Simon scale and the Terman revision of the same scale are based on the fact that memory appears to mature at a rate roughly determinable for the average child. At the age of twelve months, according to the Kuhlman revision, the child should be able to recognize objects with which he is familiar. Of several objects presented to the child he is supposed to reach out and select one. At the age of eighteen months he is supposed to be able to say such words as "mama," "papa," "baby," and to recognize objects in pictures by gaze or vocalization. At the age of two years the average child should be able to point out objects in pictures, which shows a more mature degree of recognition than that involved in the tests cited before. At the age of three years, according to the Terman revision, the baby should be able to recognize and name three of the following: a closed knife, a key, a penny, a watch, and a pencil; to give its last name; to repeat six- and seven-syllable sentences; and to repeat three digits in correct order. From then on, the questions which depend upon memory require an increasing degree of maturity. For example, in the

alternate test, in Year III the child should be able to repeat three digits; at Age IV he should be able to repeat four digits; at Age X to repeat six, and at Age XVIII to repeat eight digits in correct order. The ability to repeat sentences correctly varies from ability to repeat six and seven-syllable sentences at Year III to the ability to repeat twenty-eight syllable sentences at Year XVI.

The 1937 revision (37) of the Stanford-Binet includes still further tests of both perception and memory. To pass the second test in Year II a child must identify by name four of six common objects (*e.g.*, a kitty, a button); he must remember for long enough to recall correctly three simple commands. At two years and six months he must again name objects and must repeat correctly two digits. At three years he must remember pictures well enough to find them when mixed with other objects and must be able to repeat three digits. The same test occurs at three years and six months, at four years, at four years and six months, and five years. In Year VI the picture is complicated by a test involving copying a bead chain from memory. The test material is not reproduced here since it appears best in the context of the test itself, but it is obvious that increase in immediate memory is at least one adequate test of growth in general intelligence.

The study of the findings from the three fields—observation, laboratory experiments, and mental testing—would lead one to conclude that the child remembered readily only a very few words or digits before the age of three years. It is very natural that memory in terms of words or digits should be relatively restricted before this age, inasmuch as the child's vocabulary is very limited. It is probable that he remembers more in terms of actual instances

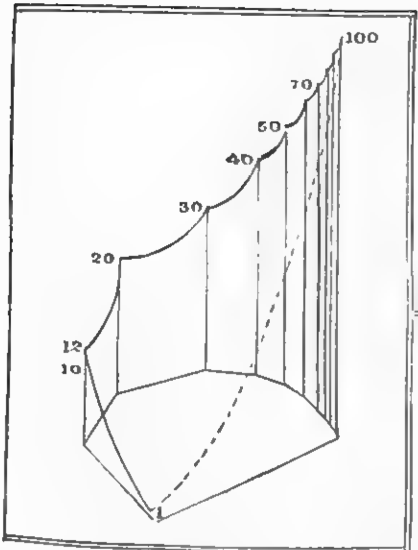
and concrete objects than he can formulate in words. It is a mistaken idea that the memory of the child is better than the memory of the adult. That which actually appears to occur is that a child is willing to repeat, over and over again, activities which he wishes to learn, where an adult, because of many conflicting interests, would find it difficult to concentrate his attention on a process of repetition so full of routine. The two-year-old is satisfied to sit for minutes saying over and over again some newly heard word. He is content to repeat after his mother simple verses and, in fact, delights in such repetition. The early period of his life is filled with such instances of repeated activities. An eighteen-months-old child delights in merely taking blocks out of a box one by one, and then returning them to the same box one by one. So interested is the child in the mere repetition of material that stories involving this element of repetition are his particular delight, and the least change in such stories will meet with immediate protest and correction on his part. As the child grows older, a greater number of experiences gives him a larger number of associations with which to tie up each new experience. This results probably in a more rapid acquisition of certain kinds of material and also in the dropping out of the great interest in mere repetition of material once heard.

Individual Differences in Memory.* Memory depends both on the general plasticity and the general functioning of the nervous system and on the degree to which training has been carried on. There are individual differences in the rate of memorizing and in the degree to which material is retained. One may find children who learn rapidly and

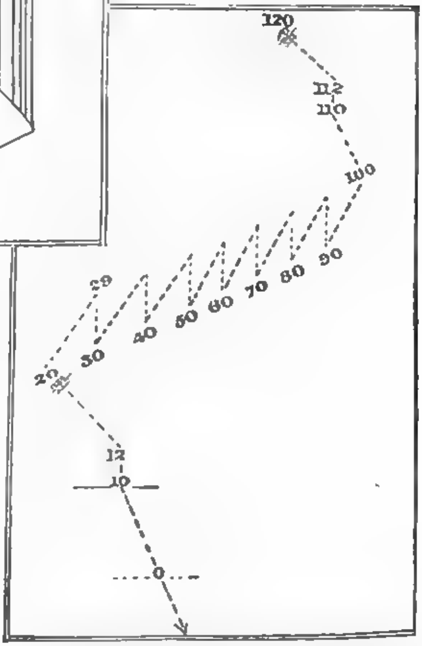
* Differences in memory appear to be due to differences in innate capacity as well as to differences in training. (Smedley, 32.)

retain over long periods; children who learn rapidly but forget easily; children who learn slowly, but retain for long periods; and children who learn slowly and forget easily. Experimental evidence to date tends to indicate that while there is by no means a one-to-one correspondence between the rapidity of learning and the degree to which the individual retains, on the average, rapid learners appear to retain for longer periods than do slow learners. Certainly such evidence as we have does not indicate that the slower the learning the greater the length of time over which the material persists.

Further individual differences in memory may be found in the types of images which the child employs in his recall. These depend largely upon the condition of the sense organs and the degree to which one set of images has received training as compared with the others. Defects in vision, hearing, or any other sense organ result in either a diminution of the number of the images which have been mediated as sensations by the defective end organ or in images which do not represent the object correctly. Inaccuracies of vision, in particular, are responsible for many peculiarities in imagery of this field. Children with diplopia appear to have distinctly confused images of words which may result in "soap" being written as "soas," "that" as "htat," or even in one word being written twice in direct succession. The child sees two words rather than one and therefore remembers and reproduces them in this manner. Images mediated by sense organs through which the greater number of experiences come, or with which the child selects out those experiences to which his attention has been particularly called, are the ones which function best as compared with images from other sensory fields.



Number form of Walter Larden, formerly of Cheltenham College, England. The faint lines are to show the perspective. (*Galton.*)



Hereditary number form common to brother and sister. (*Galton.*)

Fig. 12.

There are also other peculiarities in memory, such as, for example, number, calendar, and alphabet forms. These forms are illustrated in figures cited from Tanner's "The Child" (36). These forms appear to be used by the same person throughout the whole period of his life and are

so much a part of the thinking process that it appears to be as impossible for the person who possesses such forms to imagine being without them as it is for the individual who has not such forms to picture them clearly.

Rate of Forgetting. Different types of material appear to be forgotten at different rates. Nonsense material, which means material which does not possess meaning for the learning individual, appears to be forgotten at a very rapid rate. Nonsense syllables as learned by adults appear to be forgotten so rapidly that approximately 33 per cent have dropped out by the end of the first 30 minutes after they have been learned. Other types of material appear to have a high degree of permanence, or even to show improvement after a long time has elapsed; swimming, typewriting, and many games, such as tennis and golf, may show actual improvement after a period of six months during which there has been no practice of the material. This improvement is probably due to the fact that erroneous movements, being practiced less frequently than those which are correct, tend to drop out more rapidly than do the correct movements. Material which is closely related to the interests of the child and which has a high degree of intensity of any kind is, as has been stated before, remembered over long periods.

Methods of Training Memory.* Whereas methods of presenting material, the distribution of effort, the number of

* Children should have experience in memorizing all types of material and in reproducing materials under many types of conditions. Training in memory of names of objects or pictures does not necessarily improve memory for other words, for verses, numbers, sizes, shapes, or, in fact, memory for any other sorts of material. Methods of attack on problems involving memory may transfer. One may train a child to attend to details in order to make

sense avenues which should be stimulated at one time, and the other conditions which are operative in economical learning have been experimented upon, though not exhaustively insofar as they affect children of school age, we have as yet no real experimental evidence as to the most efficient methods of presenting material to very young children. Certain of the conditions of learning which have been worked out for older children undoubtedly do apply to young children. For example, it is a well-known fact that practice periods for young children in the first year of school must be relatively short. It is probable that they must be even shorter for preschool-age children.

Young children appear to be interested in material which they get through the eye and ear. It is probable, therefore, that much material should be presented to them in this way, but it is equally true that every sense organ should receive stimulation, and that an object should be experimented with exhaustively in order that it be made to yield every possible sensory experience which it can give to the child. Where a number of images can be associated with an object, the object appears to be remembered over a longer period. Certainly it is more apt to be remembered in its correct relations where such a process of experimentation has been allowed to go on. The child who has seen a dog but has not been allowed to touch the animal,

---

the first impression correct, to overlearn instead of learning to the point to which he can barely repeat, to learn by a whole-part method rather than by a part method, to have the correct emotional set, to check what was remembered with facts as presented by concrete objects and situations, and so forth. Such training can, of course, be done only in the most rudimentary way. Methods and general attitudes do seem to transfer. Specific training in memory for one type of material benefits chiefly memory for other material of the same kind.

or to experiment with it in any way, can remember it only vaguely, whereas the child who has touched, picked up, and played with the dog has a series of relatively clear images in terms of which to remember the object.

The first point to be stressed, then, in training the memory of the young child is that he be given as many experiences as possible with concrete objects. The second point to be considered is that, wherever new objects be perceived, connection be made between the new experience and the child's earlier experiences, inasmuch as this both heightens the intensity of the experience by heightening the interest which it has for the child and increases the number of associations which are attached to the new experience. The third point to be applied in training the memory is to tell the child simple stories which are a recitation of his own activities. Stories such as those found in the "Here and Now Book," by Lucy Sprague Mitchell, are excellent for this purpose. Such a recitation of the child's own activities in the order in which they occur serves to recall to him the things he has done and the order in which he has done them. Stories that deal with the processes of dressing, eating, talking, and walking, and so on are of much more vital interest to the child of preschool age than are stories about "The Three Bears" or "Little Red Riding Hood." The child of two will hardly listen to even so interesting a tale as that about the three bears, but he will listen with delight to a story about how he got up in the morning, put on first one stocking and then the other stocking, put on first one shoe and then the other and so on. He will listen with delight while he buttons every button on each piece of clothing. He is not bored by the innumerable repetitions involved.

EXERCISE

Observe the behavior of your subject in situations requiring memory.

What material does this child appear to memorize best?

How far does he remember the occurrence of today, yesterday, last week, last month?

What devices have you found successful in aiding him to remember?

What verses, songs, or other material does this child have at his command?

Does he appear to have difficulty in finding word with which to relate remembered experiences?

Compare the behavior of the child observed with a group of children of the same age.

What conclusions would you draw as to memory in early childhood, with particular reference to the child studied?

Bibliography

1. ANGELL, JAMES R.: "Psychology," Chap. IX, Henry Holt and Company, Inc., New York, 1908.
2. BALDWIN, BIRD and LORLE STECHER: "Psychology of the Pre-school Child," Chap. V, D. Appleton-Century Company, Inc., New York, 1924.
3. BINET, A., and T. SIMON: "Méthodes nouvelles pour le diagnostic du niveau intellectuel des anormaux," *L'Année psychologique*, **12**: 191–244, 1905.
4. BLONSKY, P. P.: "Schonheit und Unschonheit," *Archiv fur die gesamte Psychologie*, **85**: 529–558, 1932.
5. BOLTON, T. L.: "The Growth of Memory to Intelligence," *Journal of Experimental Psychology*, **14**: 37–67, 1931.
6. BOURDON, B.: "Influence de l'âge sur la mémoire immédiate," *Rev. philos.*, **38**: 148–167, 1894.
7. BURTT, H. E.: "A Study of Childhood Memory," *Journal of Genetic Psychology*, **40**: 287–295, 1932, and "A Further Study of Childhood Memory," *Journal of Genetic Psychology*, **50**: 187–192, 1937.
8. CARR, H. A.: "Psychology: A Study of Mental Activity," Chaps. X, XI, Longmans, Green and Company, New York, 1925.
9. CHAMBERLAIN, A. H.: "A Memory Test with School Children," *Psychological Review*, **22**: 71–76, 1915.
10. DALLENBACH, K. M.: "The Effect of Practice upon Visual Apprehen-

sion in School Children," *Journal of Educational Psychology*, **5**: 321 334, 389–404, 1914.

11. Fenton, Jessie C., "A Practical Psychology of Babyhood," Chaps. VII, VIII, Houghton Mifflin Company, Boston, 1925.
12. Gates, A. I.: "Diurnal Variations in Memory and Association," *University of California Publications in Psychology*, **1**: 323–344, 1916.
13. Gates, A. I.: "The Mnemonic Span for Visual and Auditory Digits," *Journal of Experimental Psychology*, **1**: 393–403, 1916.
14. Gates, A. I.: "Variations in Efficiency during the Day, Together with Practice Effects, Sex Differences, and Correlations," *University of California Publications in Psychology*, **2**: 1–156, 1916.
15. Gesell, Arnold: "The Embryology of Behavior," Harper and Brothers, New York, 1944.
16. Gordon, Kate: "A Study of Early Memories," *Journal of Delinquency*, **12**: 129–132, 1928.
17. Hao, Y. T.: "The Memory Span of 600 Chinese School Children in San Francisco," *School and Society*, **20**: 507–510, 1924.
18. Hayes, S. P.: "The Memory of Blind Children," *Teachers Forum*, **8**: 55–59, 71–77, 1936.
19. Hetzer, H., and B. H. Tudor-Hart: "Die fruhesten Reactionen auf die menschliche Stimme," *Quellen und Studien*, 1927.
20. Humpston, H. J.: "Memory Span Tests," *Psychological Clinic*, **12**: 196–200, 171–173, 1919.
21. Hunter, Walter S.: "The Delayed Reactions in Animals and Children," *Behavior Monographs*, **2**: 52–62, 1913.
22. Hunter, Walter S.: "The Delayed Reactions in a Child," *Psychological Review*, **24**: 74–87, 1917.
23. Ide, G. G.: "Educability Level of Five Year Old Children," *Psychological Clinic*, **13**: 146–172, 1920.
24. Jensen, Kai, *et. al.*: "Differential Reactions to Taste and Temperature Stimuli in Newborn Infants," *Genetic Psychology Monographs*, Vol. XII, Nos. 5, 6, November, December, 1932.
25. Pintner, R., and D. G. Patterson: "A Comparison of Deaf and Hearing Children in Visual Memory Span for Digits," *Journal of Experimental Psychology*, **2**: 76–88, 1917.
26. Preyer, Wilhelm: "Die Seele des Kindes," Berlin, 1882.
27. Preyer, Wilhelm: "Embryonic Motility and Sensitivity," *Monographs of the Society for Research in Child Development*, Vol. II, No. 6 (Serial No. 13), 1937.

28. Rasmussen, Vilhelm: "Child Psychology," Vol. III, Chap. III, Alfred A. Knopf, New York, 1923.
29. Richards, T. W.: "Psychological Tests in the First Grade," *Psychological Clinic*, **21**: 235–242, 1933.
30. Skalet, M.: "The Significance of Delayed Reactions in Young Children," *Comparative Psychology Monographs*, **7**: 82, 1931.
31. Skerrett, H. S.: "The Educability of a Two-year-old," *Psychological Clinic*, **14**: 221–224, 1922.
32. Smedley, F. W.: "Report of the Department of Child Study and Pedagogic Investigation (Chicago Public Schools)," *Report of United States Committee of Education*, **1**: 1095–1138, 1902.
33. Smith, W. G.: The Place of Repetition in Memory, *Psychological Review*, **4**: 47–73, 1896.
34. Sontag, L. W., and T. W. Richards: "Studies in Fetal Behavior," *Monographs of the Society for Research in Child Development*, Vol. III, No. 4 (Serial No. 17), 1938.
35. Stern, William: "The Psychology of Early Childhood," p. 238, Henry Holt and Company, Inc., New York, 1924.
36. Tanner, Amy Eliza: "The Child," Chap. VI, Rand, McNally and Company, Chicago, 1904.
37. Terman, Lewis M., and Maud A. Merrill: "Measuring Intelligence," Houghton Mifflin Company, Boston, 1937.
38. Thorndike, E. L.: "The Psychology of Wants, Interests, and Attitudes," D. Appleton-Century Company, Inc., New York, 1935.
39. Thorndike, E. L., *et. al.*: "Adult Learning," The Macmillan Company, New York, 1932.
40. Walton, A. C.: "The Influence of Diverting Stimuli During Delayed Reaction in Dogs," *Journal of Animal Behavior*, **5**: 59–91, 1915.
41. Watson, J. B., and R. R. Watson: "Studies in Infant Psychology," *Scientific Monthly*, **13**: 493–515, 1921.
42. Whitley, M. T.: "An Empirical Study of Certain Tests for Individual Differences," *Archives of Psychology*, **3** (19): 1–146, 1911–1912.

IMAGINATION

THE IMAGINAL LIFE OF THE YOUNG CHILD DIFFERS widely from imagination as we have it in the child of beginning school age. Like perception, the images with which the child deals are dependent (*a*) upon the condition of the sense organs and (*b*) upon the amount of experience. Images involve the re-presentation of sensory and perceptual experience.

The two processes, perception and imagination, are alike in some of the elements involved, but they show certain fundamental differences. In the first place, in perception the object is always present to the senses. This means, in effect, that, in order to have this process operative, there must be some stimuli which are impinging upon the sense organs. In the second place, perceptions differ from images in that the object being present gives a clearer impression, has a greater degree of vividness, and can be reacted to as being more detailed. It is more easily kept in the focal point of attention.

Imagination has definite advantages over perception, inasmuch as in this process no object need be present to the senses. The child in his thinking can deal with objects which are not only not in the room, but which have actually

been seen or heard or otherwise experienced in far-distant places. When he deals with images, he is freed from the domination of his environment, both because no objects need to be present, and because he can make his images react as he wills. In the end, these images must square in a measure with reality, but he may recombine them in such a way as to make an object which in itself has no real existence.

The presence of make-believe in children has been demonstrated by Markey (9), Burnham (2), and Ransohoff (11), the last chiefly in connection with reactions to ink blots. Burnham found that at the age of two and a half the median child in the experimental group used $6\frac{1}{2}$ make-believe plays or situations in $2\frac{1}{2}$ hours. At three years and four months twenty-six imaginative situations occurred in the same period. At three years and seven months the median number of imaginative situations was twenty-two. The last group was of much lower average intelligence. These results would indicate that older children indulge in more imaginative activity than do younger, a result which observers of children would have expected.

Burnham found the use of imagination as indicated by the child's conversation rose from 1.5 imaginative statements at two years to two years and five months to 8.7 imaginative statements at forty-two to forty-seven months. This author also noticed that certain of his subjects used no imaginative statements, while others used as much as 26 per cent. This study is solely in terms of the language used by the child.

Obviously individual differences play a large part in the use of imaginative activity.

Ransohoff used Whipple's ink blots and pictures cut from current advertisements with a group of children from two and a half to five and a half years of age. She divided the children into three groups, group I aged from two and a half to three and a half, group II from three and a half to four and a half, and group III, in which there were only four children, from four and a half to five and a half. Her conclusions were as follows:

1. The imagination of children improves with increasing age.

2. There are marked individual differences in the use of imaginative activity.

3. There is a positive correlation of .85 between intelligence quotient and the child's score in imaginative activity. She also concluded that imagination in children is easily stimulated. She found that the use of similar words to describe ink blots and pictures increases rapidly from age group to age group. The author found a number of subjects in the older group who used exactly the same words to describe the same pictures and blots.*

The importance of imaginative activities for the child is twofold. They give flexibility to his thinking and they act as release from too great tension.

The use of imagination in giving flexibility to thinking and in making creative work more interesting is too well known to need an extensive treatment here.

Individuals without imagination say the same things in much the same way to such an extent that when a

* See also Schachtel (14).

sentence is begun almost any intelligent person can tell how it is going to end.

Individuals lacking in imagination plan meals which are the same time after time, tell stories without the necessary vividness of detail to make them interesting, indulge in all too frequent platitudes, and in other ways give indications of the absence of the free play of imagination which enables the individual to make new and fresh combinations out of previous experiences. Verses which rhyme moon, June, and spoon and stories which deal with the same incidents in the same language and make them end in the same way as all other stories of the same type are actual examples of the workings of minds lacking in imagination.

The use of imagination as a release from too great tension can be observed both in the identification of the child with other individuals and with animals or even inanimate objects and in the direct performance of activities in play in which he could not engage in actual human contacts. Educators have frequently stated that a child identifying himself with objects, individuals, or animals was learning through this identification. We contend that identification with individuals or objects other than himself is only indulged in by the child when for some reason he has not made a successful adjustment as himself.

A child who says, "Not Sam, a choo-choo," is for the time being seeking a release from pressure which he would have to accept as Sam but which a "choo-choo" does not have to face. Moreover the "choo-choo" may often behave in ways forbidden to Sam and this provides further release. G, who had been told that he could not run in the hall,

said, "But I am a fire engine going to a fire." D, who had been told, "A big nursery-school boy does not yell in the house," said, "I am an engine blowing for a crossing," and then tooted at the top of his voice.

The earlier interpretation proposed by educators is obviously a patent absurdity, for no child ever really understands a "choo-choo" because he acts like one nor does he ever feel like a "choo-choo" at any time.

A further refinement of identification as an indication of escape occurs when the child on being a bad boy and facing punishment states, "But I did not bite Jane, it was the bad little boy from next door," or "It was the teddy bear," when he had previously played both parts. One small boy about to be punished for biting said, "But I am a man-eating lion from the zoo." Obviously a lion may bite without being punished; at least the child's consciousness so interprets it.

The techniques used by the author in the study of behavior problems of various types make use of the child's tendency to get release through imaginative play. The use of these same techniques has also been suggested by Murphy and Horowitz (10) and Frank (5). Children in the nursery school and other nursery-school-age children are allowed to play freely with the toys in the office. Their comments and the form taken by their games are noted carefully.

Subject A was a boy of three and a half who had developed cruelty toward his playmates and unusual destructiveness. A was allowed to play with a collection of ivory dogs of three sizes, three very small, one medium, and one very large. He spontaneously named them

"mother," "father," and "three little dogs." He then picked up the mother dog, put it in the box, and said, "No mothers in this house, just a father." The author attempted to put the dog back, at which A screamed, "I am throwing mother dogs away." On further investigation the reason for his behavior became clear. A's mother was separated from his father. Her feeling against the father was so strong that she refused to let A speak of him at home; she also refused to let him see A. Up to the time of the separation A had been devoted to his father. The treatment by his mother had led not to rejection of the father but to rejection of the mother and the consequent failure to obey her and revenge himself upon her by behavior to which she objected. In his play his feelings were released but in this case not relieved.

A much less serious instance of the same thing follows: D used the same small dogs to play with whenever he came into the author's office. He always placed them in such a way as to indicate that they were talking to each other, the mouth of one placed at the ear of another. He would then sit back and laugh. He was asked, "What are those dogs doing?" to which he replied, "See the little box on the table? The dogs are whispering, 'There is c-a-n-d-y in that box over there.'" In this case the activity constituted an obvious release from a situation that was annoying him at home but that he found amusing when reenacted in play.

The use of imaginative activity to escape from reality may cause serious behavior difficulties. So serious may it become that the child gives many evidences of the behavior characteristic of catatonic dementia praecox cases. G, age three, found so much interest in imaginative activity

that it was difficult to bring him face to face with reality. On many occasions he was so detached from his environment that he would not hear when spoken to. His eyes were not focused and he appeared to be asleep with his eyes open. He was placed in the nursery school to be cured of this dissociation from reality. He would sometimes get up, start toward an activity, and remain standing completely cut off from his environment. Investigation revealed that he had been under the care of a nurse who talked incessantly. His intelligence quotient was 160. Her intelligence was such that she had failed in the third grade and was never able to go beyond that educational level.

The usual techniques were used to arouse the child's interest, among other things the preparation of food which he appeared to like. His mother stated that he liked pink junket. This was prepared, as was creamed chicken, another of his favorites. His attention was attracted by lifting his chin and speaking to him directly. He was told, "We have pink junket and creamed chicken for dinner. Come on, let's go eat them." To this he replied, "No, I would rather sit here and think about them." A training period of six months was necessary before he became adjusted to normal environmental stimuli.

Imaginative activities should never be permitted as a substitute for reality, but, as has been stated, they are essential to the development of an interesting type of mind.

Imaginary playmates are another phase of imaginative activity. Only children or youngest children between whom and the next youngest child there is a gap of three or more years appear to show this type of behavior frequently, but it occurs also among other children. Hurlock and

Burnstein used a questionnaire directed toward determining the percentage of individuals with imaginary playmates and the background of the child who had had imaginary companions and obtaining some facts about these imaginary companions. The questionnaire was given to 701 high-school and college students, 393 women and 308 men. These experimenters found that 31 per cent of the women and 23 per cent of the men reported having had imaginary playmates. This percentage is probably larger than it appears from the results for this group, inasmuch as memory of early childhood activities has been demonstrated to be very poor.*

Imaginary playmates were as frequent among rural as among urban children. Only 3 per cent of the subjects studied had imaginary playmates because they were not able to get along with real friends. Hurlock and Burnstein (8) state that only children were not found to be more subject to imaginary playmates than those with brothers and sisters. Svendsen's results are based on questions to parents whose children were playing with imaginary companions at the time. She states that the average difference between her subjects and their next oldest sibling was five years and four months.

Our own studies are based on children in nursery schools and on the reports of their parents. Imaginary playmates appear to develop somewhere between two and three years of age, but it is uncertain whether or not they are present before this time. The child's use of language is so poor that he may be communicating with the imaginary with gestures not correctly interpreted by the observer. A two-and-a-half-year-old in a nursery school continually looked over

* See Chapter Ten.

his shoulder when riding on the kiddy-car, shook his head "yes" or "no," and murmured apparently to himself. Just after his third birthday he said to the writer, "I brought Gogo to school and left him in the locker." On being asked, "What is Gogo wearing?" Steve replied "A green sailor suit." Careful questioning of the nursery-school staff revealed the fact that on certain days Steve always played with two of everything, when on other days he was content with one. This behavior was checked both when he was playing with the single objects and when he was playing with two of a kind. When asked if Gogo was in nursery school he always replied, "Yes, he's here," when playing with duplicate objects and "No, he isn't in nursery school," when he played with a single set of objects. As Steve's language increased, his conversation with Gogo became fuller. At three and a half Steve was attracted by a group of which he shortly became the leader. Gogo stopped coming to nursery school but was played with at home until Steve was four years and four months old. Imaginary companions may be of the same age and sex as the child who is playing with them.*

Productive and Reproductive Imagination. The child's imagery may be reproductive in the sense that it is a representation of objects and situations actually experienced. It may be productive in that it may involve a combination of the objects previously experienced into new objects or new situations. In both cases the elements which are involved are directly referable to reality, but in the case of productive imagination, the objects produced may have no real counterpart. One may imagine a six-legged cat, in which case one has productive imagination, but all that

* See also Griffiths (7) and Green (6).

one has, if one analyzes the experience, is a cat such as one is familiar with, to which one has added two additional legs. The two-headed dogs so familiar in folklore and fairy tales are instances of the same sort of productive imagination. The fairy whom one would never see in reality is merely a human being extremely diminished in size. One may in imagination live scenes in which one will never be able to take part in real life.

The daydream is often an excellent illustration of productive imagination, but planning a trip to a point which one has never visited or attempting to recreate the experience of another individual may also involve productive imagination. Productive imagination is of value insofar as it enables individuals to make adjustments to future events, to control situations with which they have had experience only in part, in the absence of these situations, as a mental exercise on a par with reading the short story, and so on. One significant test of the value of productive imagination to the individual is the extent to which it furthers or militates against his adjustments to reality.

Children's Lies. Productive imagination seems to be extremely strong in children. It is difficult for them to determine the difference between what they have actually experienced and what has come to them as productive imagination. The experience of the child is so limited that he has not those checks which are a commonplace in the experience of the more mature individual. If one were to try for himself so simple an experiment as thinking first of a brown horse such as one ordinarily sees, and then of a pink one, one would find that there were certain differences apparent in the processes involved in dealing with the images (3).

1. One would find the image of the pink horse difficult to call up.

2. The image would be difficult to hold; *i.e.*, it would be relatively unstable. The instability would show itself, probably, in the disappearance of color from the horse. The horse would tend to return to the color of horses seen frequently, probably a chestnut color or brown.

3. The image would be less detailed; for example, it would probably be seen in the flat rather than as having three dimensions and would almost certainly not give a clear impression of hoofs, mane, tail, and the like.

4. The emotional content which would accompany the image of the pink horse would be quite different from the reaction to the animal with which one had had much previous experience.

5. The train of associations aroused by the animal which is the result of productive imagination would probably differ widely from the train of associations aroused by the animal to which one was in the habit of reacting (4).

Some or all of these checks on productive imagination are present in the thinking of the mature individual, but they develop gradually and as a result of many experiences with common objects and situations. These checks are present only in the most rudimentary way in the thinking of the child of preschool age, and, for this reason, he all too frequently confuses the products of his productive imagination with memories of actual experiences. For him, the image of the bear which he states that he has seen on the lawn may be as clear as the image of the dog with which he has really been playing. Much of children's so-called "lying" is traceable to the constant confusion which exists

in the child's mind between what he has seen and what has been told to him, or what he has imagined. In some cases the vividness of the child's imagination is so great that it is wise to help him check up with reality. One says to him after a story which has no foundation in experience, "That was a nice story, just like the stories in the books; but, of course, it wasn't true, was it?" Often if one will tell a somewhat similar story, commenting on the fact that "this story isn't true either," one will help the child to see the difference between the story and what he has actually done or seen. Similar devices can be used, such as showing the child that an animal of large size could not possibly have been in the small box in which he is telling you it has lived, and so on. It is as natural for the child to exaggerate and to tell the so-called "lies" of imagination as it is for him at a later date to react strongly against such stories when they are told to him and he is expected to believe them. His reaction to the fact that he is being deceived by the Santa Claus myth, for example, is sometimes very strong.

Children's so-called "lies" are often the response to suggestion on the part of the adult. If one says to the small child coming into the nursery school, "What did you see on your way to school this morning?" and he responds, "Nothing but a car," it is wise not to urge him too strongly to tell you what he really saw, for such urging often produces weird stories. In one case which the author remembers, a small child, so urged, responded with "A great big bear ran after the car and he ate me up." The child quite evidently thought that he had given an experience wild enough to satisfy even the most exacting adult.

No child should be allowed to tell without check the wild stories that may be classified as lies, for he may well develop

into an individual with none of the normal checks enabling him to differentiate between truth and falsehood. Everyone has illustrations of individuals in his own social group whose stories are so unrelated to fact that no one trusts their reports.

Children should also have made clear to them the difference between the social falsehood that society appears to require for adjustment and the falsehood told without reason or told to people who trust him. A young child who says to his mother, "I hate you, go away," is expressing a real feeling and one that all of us experience at times in connection with people of whom in general we are fond. Severely frustrated individuals dislike the persons who have put in the blocks even if these are usually loved. The situation should be explained to children in simple terms such as the following: "Yes, we do sometimes hate the people that we generally like, but we do not say so. If possible, we are polite."

Not only here does the child have to face the fact that falsehoods are sometimes required of him. He hears his mother say to a friend, "I cannot come to dinner with you because I have another engagement." Later he finds that his mother has had no engagement and therefore feels that she has lied—as indeed she has. At this point or earlier she should explain to him that in order to avoid hurting a friend's feelings she sometimes does not tell the exact truth but that she always tells the truth when it really matters and always to members of the family.

It would be far better from the point of view of society if people always told the truth. It would also be infinitely better for mental hygiene, but since society has not yet

reached this plane, the actual situation should be made clear to the child. Any child or adult rash enough to tell the truth, the whole truth, and nothing but the truth, even for twenty-four hours, would be completely ostracized socially. The situation is regrettable but true.

The Place of Fairy Stories. In spite of the fact that one might feel that the vivid imagination of the child would not need the further stimulation of fairy stories, an examination of the actual value of the fairy story to the child* would convince one that it could not well be omitted from his education. In the first place, the life of the fairy story ordinarily conforms very much to his experience and, therefore, in a way, gives a concrete expression to much or all of his thinking. In the second place, the content of the fairy story gives him much material in terms of which to interpret verbal references which are a part both of literature and of everyday conversation. When one hears said of a person that she was an "ugly duckling," one knows at once from those two words what the history of the person referred to has been. If one had not heard, in one's childhood, the story of the ugly duckling, the force of the reference would be lost. Innumerable instances of similar nature could be given. Finally, the myth and the fairy story embody many of the ideas and the ideals of the primitive peoples and are, therefore, as much a part of the child's heritage as any other type of material which gives him a background of history and literature. The types of story to be avoided are those which produce gruesome images, or images of any kind which may come up when the child

* There is little or no interest in fairy stories until four years of age or over. Simple fairy stories can be told to four-year-olds, but it is not until the average child is six or approximately six years of age that he seems to derive great pleasure from tales of this type.

is tired or half asleep and frighten him. Such stories as the one repeated by a five-year-old, in which "the giant ran down the street cutting off heads and picking babies up off their feet and dashing them to pieces," are hardly permissible. Other types of fairy stories add, as has already been stated, to the richness of children's experiences.

The Dependence of Imagery on Experience. Since imagination depends in a large measure, as has been said of perception, (*a*) upon the amount of experience which the child has had, and (*b*) upon the condition of the sense organs which have mediated the experience, it follows that no sensory defect which can be corrected should be permitted to exist.* Not only must the experience of the child be as rich, wide, and varied as possible, but the sense organs which are to mediate this experience must be in perfect condition.

Dependence of the Imagination on the Condition of the Sense Organs. The images which are mediated by a defective sense organ bear little resemblance to the object or group of objects for which they stand. Colvin cites a paragraph from Allen's (1) book, "Civics and Health," as to the effect of a visual defect on both perceptions and the images of words, which is of sufficient interest to warrant its quotation in full:

> Wherever school children's eyes have been examined, from six to nine out of thirty are found to be nearsighted, farsighted, or otherwise in need of attention. A child is dismissed from school for obstinately declaring that the letter between "c" and "t" in "cat" is an "o"; a pupil in her fourth school year was recently brought to me by her teacher with the

* See STINCHFIELD-HAWK, S., "Moto-kinaesthetic Speech Training Applied to Visually Handicapped Children," *Outlook for Blind*, **38**: 4–8, 1944; "Speech Training in a Nursery School for Visually Handicapped Children," *Outlook for Blind*, **38**: 39–41, 1944.

statement that she did unreasonably poor work in reading, for an intelligent and willing child; a boy is punished for being backward. These three cases are typical. Examinations showed that the first child was astigmatic and not obstinate; the boy had run a pin into one eye ten years before and destroyed its sight; while the second girl was found to be afflicted with diplopia, and in a friendly chat told me the following story:

"I very often see two words where there is only one. When I was a very little girl I used to write every word twice. Then I was scolded for being careless. So I learned that I must not say two words, even when I saw them."

The case of Miss Keller, who does all of her thinking in terms of cutaneous, kinesthetic, and organic imagery, is an excellent illustration of the ability of the individual to do his thinking where the sense avenues through which the major portion of experiences come for the average individual are cut off; but her images of objects are, nevertheless, quite different from those of the average individual. They are not good representations of the objects as they are experienced by most individuals. Auditory defects may lead both to incorrect hearing of words and to incorrect spelling of them, inasmuch as they are frequently spelled as they are heard. The incorrect auditory image leads to an incorrect hand motor response when the words are written and frequently to incorrect pronunciation when they are spoken.

Lowered acuity in any sensory field will have its effect on the imaginal content mediated by the sense organ which is functioning at the low level. Even when there is no sense-organ involvement, there appears to be a tendency for certain individuals to prefer images from one sensory field rather than images from others, but there appear to be no real image types. Some children seem to learn better

when material is presented through the eye than when it is presented through the ear: others learn better when it is presented through the ear than when it is presented through the eye, but, in general, the nature of the material and the training which has been given to the individual govern the type of images used at any particular moment. We tend to image the odor of coffee and the odor of perfume as olfactory, a ship at sea as visual, and the tone of a cornet as auditory.

Dependence of Imagination on Training. That training is influential in the type of imagery used is clear from certain facts.

1. One can develop a specific type of imagery by practicing over a prolonged period, as, for example, one can increase the vividness, the detail, and the ease of arousal of images in the visual field by deliberate practice in visualization.

2. Students appear to learn material better when it is presented through the sensory field in which they have had practice during the period just preceding the presentation period. For example, students under the lecture system appear to get material better through the ear, whereas those who are made to get material directly from the original source, by reading, appear to get material better through the eye.

The effect of too much training in the use of verbal and symbolic imagery, as opposed to training in the use of concrete imagery, will be discussed in a later paragraph, but it cannot be too strongly emphasized that training in concrete imagery should be continued to some degree throughout the school life of the child, and that training of this sort should be particularly emphasized in the preschool period,

since that is the period when experimentation with objects and interest in the sensory qualities of objects in and for themselves appear to be at their height.

The Kinds of Images. There are as many types of images as there are sensory fields. There are auditory images, visual images, pain, tactile, and temperature images, gustatory and olfactory images, images of organic origin, and images which come from the sense organs in the muscles, tendons, and joints (kinesthetic images). Certain of these fields tend to yield a wider and more varied experience than do others, and the images which come from these fields, therefore, tend to be used more frequently. At all ages except during infancy, hearing and sight as distance receptors are used much more frequently in the control of the individual's reactions and in gaining experience than are the sensations from the other fields. It follows, therefore, that images which are the result of visual and auditory experience tend to be used more frequently, to become clearer, more fixed, and more detailed, and to play a larger and larger part in thinking as the child grows more and more mature. In some cases, however, verbal imagery or some form of kinesthetic imagery plays the major part in thinking.

Touch and taste, which play such a dominant role in the acquisition of experience of the baby and the child below the age of two, appear to play less and less role as the child matures and passes from the experimental manipulative period into the period in which he deals increasingly with words. He should receive every possible type of experience in the realm of taste and touch in the first four years of his life, in order that he may store up images in those fields during the period in which he is particularly interested in the sensations which come from those end organs. During

the latter part of his life education will lay so extreme a stress on imagery in terms of words seen and words heard that it is well to have a store of concrete images from the other fields which will function in connection with imagery of the more verbal type.

Organic imagery appears to be difficult to rearouse and to be relatively infrequent in use. The extent to which kinesthetic imagery plays a part in the life of the young child is as yet undetermined. Inasmuch as the muscular sets and bodily attitudes are relatively undeveloped at this period, thinking cannot go on in those terms, but the bases for muscular sets and attitudes which will play a part in the thinking of the more mature child and of the adult are undoubtedly laid during this period.

Concrete vs. Symbolic Imagery. The tendency to use words as a substitute for concrete experience probably develops much beyond the preschool period and in response to the school situation. If one takes into consideration the fact that speech is practically undeveloped except as pure vocalization during the first year, and that it is little better than the one-, two-, and three-word sentence at the beginning of the second year, one realizes that, during the first two years at least, there is little that can be called verbal imagery. When speech is being developed, every effort should be made to tie up the verbal experiences with concrete material. It is perfectly possible so to stress verbal imagery that, unless the proper connections are made with concrete images which the verbal image represents, the experiences are lost sight of and the child grows to depend more and more on a purely verbal type of experience. The significance of this in the appreciation of literature of all kinds can be clearly seen. Much of what constitutes literary appreciation

depends upon the ability to revive clearly concrete imagery in many sensory fields. A quotation from "The Eve of St. Agnes" will serve to illustrate this point:

> While he from forth the closet brought a heap
> Of candied apple, quince, and plum, and gourd;
> With jellies smoother than the creamy curd.
> And lucent syrops, tinct with cinnamon;
> Manna and dates, in argosy transferred
> From Fez; and spiced dainties, every one,
> From silken Samarcand to cedared Lebanon.

Verbal imagery may be of three types: verbal-visual, *i.e.*, rearousal of words seen: verbal-acoustic, rearousal of words heard; and verbal-tactile-kinesthetic, rearousal of imagery concerned with the movements of the throat in speaking the word. If one thinks of rain in terms of the way the rain looked, one has a visual image; if one thinks of rain in terms of the word "rain" seen, one has a verbal-visual image; if one thinks of it in terms of the word "rain" heard, one has a verbal-acoustic image; and if one thinks of it in terms of movements of the vocal apparatus in producing the word, one has a verbal-kinesthetic image. Verbal and symbolic imagery is extremely important in the highly developed thought processes. Most abstract scientific thinking, in fact, most abstract thinking of all kinds, is carried on purely in verbal and symbolic terms. It may even be carried on in that peculiar kind of imagery which Colvin (4) calls "mimetic." Meanings carried in these terms

> . . . are represented by images of curves of zigzag movements, in which often there appears a sort of plot, with a distinct rise to a climax, and perhaps a falling off at the end.

Such imagery may be carried in terms of reproduction of bodily attitudes or sets. Colvin summarizes this idea in these terms:

> The meaning of a situation is after all an attitude and . . . must in the last analysis be a motor affair. Thus it is but a step to the conclusion that this general dependence of experience for its significance on motor adjustments has left a deposit of "mind-stuff" that symbolically represents concrete situations not actually present, but ideally represented.

In a word, this type of imagery does not always reinstate a concrete adjustment, but rather enables the individual to think in terms of a motor symbol which stands for that adjustment. Thinking of this type would probably not occur in the young child, but general attitudes developed in the preschool period might readily give the bases for attitudes and sets which would be carried in terms of mimetic imagery in the child's thinking at a later date.

Operation of the Laws of Association in Imagination. Imagination is governed by the same laws of association as those that govern the memory processes, *viz.*, the primary laws of contiguity and similarity, and the secondary laws of recency, frequency, and intensity. In children, the associations often show no logical connections. Children's stories in particular illustrate this lack of logical connection between images. A child will begin with a story of a bear and will shortly be telling about "a little girl that fell down and tore her dress." As examples of such stories, Stern (15) cites the following:

In the case of Hilde, aged three years:

> Hilde: "And then they shut the fowls' door, and the fowls lie down alone, shut their eyes, and go fast asleep. But look, I saw they didn't eat grass today but they eat hay."
>
> Her mother says: "But hay is the cut, dried grass!"
>
> Hilde: "But see, it was on it, and the fowls bit it off. But now listen there came a great chair (she had just run against a chair), and then the fowls sat down on it."
>
> Her mother says: "Dear me!"

Hilde: "Well, now then they got one of those birthday books . . . Look at the fowls' stove—the chickens burnt themselves on it. Then they fetch out of the kitchen wood and coals and a little box where lights are hidden (description instead of the unknown word match box). Then the cock strikes a light. Now what are the cock father and mother going to do today? (She evidently did not know yet what she should do with them.) They go to dinner today and eat soup. . . . And there is a wash-stand and all the fowls have washed themselves clean, and laid the little fowl-brother on the swaddling table and dried him again. Then came too such a pretty new book, so many pictures. There were so many witches in it, so black they were. But they had no long noses, they had made their noses small again; then they washed themselves clean. Look at a fowl-witch."

The author has on record another excellent illustration of the story of a preschool-age child. M, aged three years and eight months, told the following: "And my little doggie was on the shelf and it gotted losted and it wented to sleep . . . and my dollies go to sleep, and they have dresses on and they eat . . . and I like ice cream for parties, and at John's party I went in an automobile and the automobile had a horn, and it went toot-toot. My horn goes toot-toot and my daddy says stop and I stop."

With increasing maturity,* children select more and more logically connected words for the expression of the products of their imaginations. It is probable, therefore, that the process becomes of more value both in imagining events or situations which children wish to bring about, and in their imaginative play.

EXERCISE

Observe your subject during at least three play periods.

In what types of plays does he engage?

* Ransohoff (11) finds clearly marked differences between college students and preschool-age children in the number of associations aroused by pictures

Classify the dramatic plays present as to the main object or main activity represented, *e.g.*, house play, transportation play, and the like.

Describe the relation between the type of toy used and the type of imaginative play.

Describe imagination as shown in the use of building blocks, drawing materials, modeling materials, etc.

Describe the role of imagination in the interpretation of pictures and music and in stories and songs which the child himself invents.

Give illustrations verbatim of stories which your subject has told. For the same phenomena as listed above, observe the behavior of a group of children of the same age as the subject studied.

Draw conclusions as to the development of imagination in children.

Bibliography

1. ALLEN, WILLIAM H.: "Civics and Health," Ginn and Company, Boston, 1909.
2. BURNHAM, M. P.: "Imaginative Behavior of Young Children as Revealed in Their Language," unpublished Ph.D. dissertation, Teachers College, Columbia University, New York, 1940.
3. CARR, H. A.: "Psychology: A Study of Mental Activity," Chap. VIII, Longmans, Green and Company, New York, 1925.
4. COLVIN, S. S.: "The Learning Process," Chaps. VII, VIII, The Macmillan Company, New York, 1912.
5. FRANK, L. K., "Projective Methods for the Study of Personality," *Journal of Psychology*, **8**: 389–413, 1939.
6. GREEN, G. H.: "The Daydream," University of London Press, London, 1923.
7. GRIFFITHS, R.: "Imagination in Early Childhood," Kegan Paul, Trench, Trubner & Co., London, 1934.
8. HURLOCK, E. B. and M. BURNSTEIN: "The Imaginary Playmate: A Questionnaire Study," *Journal of Genetic Psychology*, **41**: 380–392, 1932.
9. MARKEY, F. V.: "Imaginative Behavior of Preschool Children," *Child Development Monographs*, No. 18, Teachers College, Columbia University, New York, 1935.

---

and ink blots and in the number of words used to describe the images aroused.

10. Murphy, L. B., and R. Horowitz: "Projective Methods in the Psychological Study of Children," *Journal of Experimental Education*, **7** (2): 133–140, 1938.

11. Ransohoff, M., "A Study of Imagination in Young Children," Master's thesis in the Library of the University of Cincinnati.

12. Rasmussen, Vilhelm: "Child Psychology," Vol. III, Chap. IV, Alfred A. Knopf, New York, 1923.

13. Russell, Roger W.: "Studies in Animism; V. Animism in Older Children," *Journal of Genetic Psychology*, **60** (part II): 329*ff*.

14. Schachtel, A. H., "The Rorschach Test with Young Children," *American Journal of Arthropsychiatry*, **14**: 1–10, 1944.

15. Stern, William, "The Psychology of Early Childhood," Chaps. XIX, XX, Henry Holt and Company, Inc., New York, 1924.

16. Tanner, Amy Eliza: "The Child," Chap. VII, Rand McNally & Company, Chicago, 1904.

THE THINKING PROCESS

REASONING MAY BE DEFINED AS TRIAL AND ERROR IN THE field of ideas. In trial-and-error learning of a sensorimotor type the activity is overt. There is a diffusion of activity over a wide area and out of the great mass of activities those which appear to adjust the individual to the situation are selected. This selection may be conscious or unconscious. In fact in most learning of the sensorimotor type it is both. In reasoning the ideas are tried out one after the other with little or no overt activity and are discarded when they do not suit the situation. They are accepted consciously when they do appear to solve the difficulty.

Such a problem as Fig. 13 illustrates the process clearly. Move three lines from Fig. 13 and leave three complete squares. No lines must be left over. Pencil and paper should not be used to solve this problem. If pencil and paper are used, the problem will become one of sensorimotor learning.

A subject faced with this problem must now go through the steps in the reasoning process outlined by Dewey.

Dewey, in his book "How We Think," outlines the five stages in the thinking process somewhat as follows: (*a*) the awareness of a difficulty, (*b*) its location and definition,

(*c*) the suggestion of a possible solution, (*d*) experimentation with the bearings of the solution, and (*e*) its rejection or acceptance.

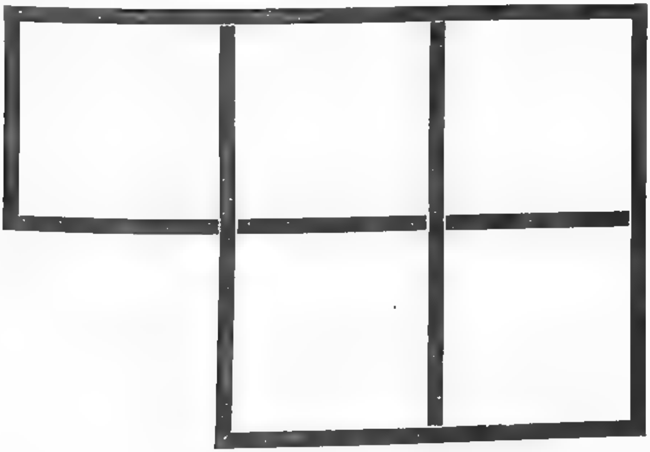


FIG. 13.

In Fig. 13 the process is as follows: First a "felt" difficulty is present in all sensorimotor learning. This step is not characteristic solely of the thinking process. At step two we begin to employ logical thinking, *viz.*, the location and definition of the difficulty, in this case selecting the three correct lines. Step three is the formulation of an hypothesis or suggestion of a possible solution in the form of ideas. A running account of what goes on is somewhat as follows: "If this line is removed and these two, there are still lines left over, incomplete squares." The hypothesis has been experimented with, and it has been rejected.

This process continues as one after another the lines are selected and rejected until the correct solution is reached. No subject in our laboratory has ever solved this problem at a glance. The so-called "intuition" described by

Kohler (7), Kofka (6), and others has therefore not functioned, at least in our subjects. This process of conscious selection and rejection once carried to its conclusion usually is retained.

The differences between this process of logical thinking and learning by sensorimotor adjustments are clear, as are the advantages. In the first place, there need be no overt activity. In fact overt activity does not occur until the process reaches the stage of final solution. In the second place, problems may be solved in the absence of all external stimuli. It would be entirely possible to solve Fig. 13 away from this book or any drawing of the figure. Solutions in the absence of the stimulation may actually occur in sleep, *e.g.*, the solution of geometry problems between falling asleep one night and awakening the next morning. Lastly such solutions once arrived at are usually remembered for all time even by young children. Brainerd (2) in discussing the learning of Ruth states that once she had arrived at a solution of the problem of securing a basket strung out of reach she thereafter used the same method to obtain it. Even where the process appears to be forgotten momentarily, a very short practice is all that is necessary in order to revive it to the point that it functions again with a high degree of accuracy. Alpert's (1) subjects working with problems similar to those used by Kohler with apes used both sensorimotor learning and analysis in their solutions. Brainerd's subjects also used both methods. Recall of the solution once arrived at appeared to be excellent in both sets of experiments.*

* For a series of experiments comparing children and adults see HEIDBREDER, E. H., "Problem Solving in Children and Adults," *Journal of Genetic Psychology*, **35**: 522–545, 1928.

Moreover, both Brainerd (2) and Alpert (1) found a transfer of the general principles underlying the solutions from one problem situation to others of a similar nature.

Alpert explains her results in terms of insight but actually they involved a long process of trial-and-error learning followed or accompanied by analysis. In other words, her subjects and Brainerd's subjects used the methods which we are accustomed to designate "logical thinking," together with overt responses of a trial-and-error nature.

Most reasoning in early childhood is of this type. Reasoning alone in the absence of overt response is rarely encountered in early childhood.

Ability to solve problems in terms of certain types of logical thinking is apparently present also in apes (6, 7). The same type of response which Kohler found in apes was found by both Brainerd and Alpert in children.

These stages, so clear as to be easily followed when the process of logical thinking at maturity is analyzed, are present in elementary form in early infancy. The thinking process itself, however, shows as wide a difference from the same process in adults as do the other reactions of young children when compared with the same reactions at maturity. In the first place, the awareness of the difficulty produces adjustments almost wholly motor in character. Hunger produces a cry and a series of random movements. These latter often result in bringing a child in contact with the source of food. If the cry alone is adequate, as, for example, when the bottle is placed and held in the correct position, crying alone may be the activity which the child uses in the hunger situation. Similarly, other felt difficulties

which must be satisfied and discomforts which must be eliminated are reacted to in terms of motor adjustments.

As a child matures and speech develops, responses may still be made on the plane of trial and error but in terms of spoken words. A need for a toy may cause the child to say a single word, as, for example, "Duck." This produces in the adult to whom it is addressed action which results in the object's being brought to the child. A series of sounds resembling the word "duck" but inadequate to make the adult produce the toy often precedes the spoken word which brings the successful result. The situations are present and produce concrete results. The difficulty is felt, correctly located, and responded to, and the hypothesis that a sound will produce action leading to the elimination of the difficulty is tried out. It is accepted or rejected in terms of the success or failure with which it meets. Had he merely pointed at the object and his family given no response because they wished him to progress from gesture to speech, the hypothesis that pointing would cause the object to be given to him would have been discarded, and a second reaction, pointing and accompanying this pointing with speech, substituted. If this reaction met with success, it would probably be selected later as a way in which to solve this and similar difficulties.

This chain of vague ideas and clear reactions probably represents the thinking process as it occurs in early childhood. No such mature reaction as sitting down to solve a difficulty in terms of ideas alone is possible. Motor reactions are always present.

As children mature, trial and error in terms of ideas will take the place of trial and error in terms of activity, but the

relation between this later process and the earlier behavior can clearly be seen. A child of two or under may try a cry to get his mother to come when he is lonesome, but, if this fails, he will try other means. A child of six may decide between the relative effects of a call for help, crying, or making a sound as of something smashing, and, on the basis of past experiences, choose the act which has produced the most rapid response on previous occasions without going through the actual motor responses involved in trying out either of the other two. He recalls and discards mentally all but the one reaction which he thinks will bring his mother promptly.

Growth in logical thinking then takes place partly in the line of the substitution of ideas for motor adjustments. Clear thinking, however, does not depend solely on this, for the ideas substituted may be erroneous: the hypothesis may be formed on the basis of inadequate data; there may be an unwillingness or an actual inability to wait until all the facts are in; there may be an inability to perceive the relation between the present situation and similar ones, and the possible solution may be accepted or rejected without sufficient experimentation. All these faults may be and frequently are present in the thinking of young children. Ideas which involve time, size, weight, distance, direction, proportion, and number will be largely incorrect, for in these fields the child is handicapped by lack of experience. As has been stated in the chapter on perception, these things cannot be perceived correctly even when present. Children's ideas in regard to them are in the same case as are their perceptions. The memory process in children appears to be less good than it will be later. Experiences are recalled less easily, with less detail, and somewhat less

accurately than they will be recalled even at school age. In addition to the inadequacy of ideas in the special fields cited, the child is further handicapped by the small size of his vocabulary and the meager meaning of the words which he has learned. This is true, certainly, for the first five years of his life. It is no wonder that we hear constantly of the funny things that children say. These sayings are based on the inadequacies of the thinking process and are seldom as humorous to the child who says them as to the adult who repeats them.

The hypothesis may be formed on the basis of inadequate data, as, for example, when D, wishing to fill his cup, turned the hose up and then placed the cup under the upturned nozzle. The cup remained empty but D was drenched. His statement, "But water runs down," explained the action.

The difficulty may be failure to perceive a similarity, or conviction of a similarity where none exists. The child who says, when the car slows down for lack of gasoline, "Oh, car tired; must rest," is reacting on the basis of a false similarity. The child has assumed that because he slows down and stops when tired, other things which slow down and stop must do so for the same reason. He accepts the hypothesis without experimentation. A second failure to start the car some time later meets with the response, "Still tired." The adult, while this poor type of reasoning is being carried on by the child, is constantly searching for the solution of his difficulty and will not be content until his tests have revealed it or until a mechanic who can locate the difficulty has been obtained.

As illustrations of unwillingness or inability to wait until all the facts are in, we have the countless instances in

which the child insists upon going ahead with what he intends to do even while the interested adult is attempting to present facts which should deter him. The fact that attention can be concentrated only for brief periods and the fact that any desire is likely to issue in action immediately operate together to make impossible the type of thinking which requires a sifting out of data.

In spite of the inadequacies obvious in the thinking process of young children as compared with adults, appeals can and should be made to reason, particularly with reference to conduct. Such appeals must be worded simply and clearly, and should be free of all irrelevant details. Children can and do reason relatively well when the problem is suited to the level which they have reached, as the following illustrations show.

John, aged four and a half, was told that he must not talk while his father was talking. John said, "But he always talks when I talk. Why should he and not me?" J was told that he must lift his hat to ladies. "What to do when I left my hat home?" he asked.

D was told that he must not go on the grass because his shoes would get wet. Shortly afterward, his mother looked out to find him playing on the grass barefoot.

Rasmussen (9) gives some interesting illustrations of logical thinking in children, two of which are quoted herewith:

Her little sister pulled her hair and R screamed. Her mother said excusingly, "She doesn't understand." But R objected, "Then she could pull her own hair; but she doesn't do that."

R would not eat her food, and to entice her to do so her mother said, "Very well, now it is my birthday, and you are a strange lady who is

paying a call. And so I ask you, 'Won't you have a cup of cocoa?' R interrupted hurriedly, "No thank you, I have just had lunch at home."

The following are further illustrations of the types of thinking which go on in childhood. D said of a man who was swaying from dizziness produced by illness, "He has been running round and round like me." J heard her mother say, "If people want to break things, I wish they'd break my old plates." J broke several, with consequent punishment. D said on visiting a friend, "I want to see the kitty under your stove." On being told, "But we have no kitty," he said, "Stoves have kitties under them and you have a stove." An old cat, the property of the cook in his home, was frequently to be found under his stove. Because of his limited experience he thought that a general rather than a special condition. His reasoning was sound from the point of view of his experience but unsound from the point of view of usual experience.

Frequently reactions which seem to the adult disobedient and impertinent come from children's incorrect reasoning. "You must not answer back" may be followed by "But you always answer me back." In many cases no impertinence is meant until punishment follows the child's attempt to find the reason why he should do what obviously the adult is not doing.

Training in Reasoning. The development of the reasoning process in children is aided by (*a*) giving a rich background of experience on which to draw, (*b*) pointing out similarities where these exist and helping children to check on things that appear to be similar but are not, (*c*) setting an example of clear thinking, (*d*) giving full meaning to language (8), (*e*) showing the child how to verify his conclusions, *i.e.*, showing him how to check on the results of his thinking.

This last often involves training in willingness to wait until all the facts are in.

Giving a Background of Experience. The wider the experience which children have with concrete objects and situations, the more accurate will be their reasoning in regard to the behavior of such objects and the meaning of such situations. The child who learns that a stone on flat ground does not move easily when pushed must also learn that the same stone on a slope can be moved with but little effort. If he does not learn this, he will not react quickly enough when another child pushes the stone down a slope in his direction. If he has had experience only with stones on slopes, he may run when a stone on a flat surface is pushed, though this will move so slowly, if it moves at all, that running is unnecessary. A child who learns that an expression of anger means that he has been naughty must also learn that an expression of anger may mean that the parent is irritated with himself because he has not been able to carry out a project. Actual experience in early childhood will make it easier for a child both to check on his own actions and to obtain in its correct form material from the experience of others transmitted to him through books, conversation, and the like. Other things being equal, to the extent to which training has been rich, wide, and varied, thinking will be improved. The limitations placed by experience in any one field will to that extent place difficulties in the way of correct thinking and therefore to correct response in that field. One cannot think correctly about the effect of cold unless one knows its effect both on liquids and on solids. For if one puts liquid in a pitcher in zero atmosphere, the pitcher contracts but the freezing liquid expands with the usual result that the pitcher breaks.

Illustrations of inadequate reasoning due to lack of experience can be multiplied indefinitely. They can always be found with relative ease in the thinking of children.

Pointing Out Similarities. In the chapters on memory and on habit formation, the transfer of the results of experience from one situation to another, it was pointed out, did not take place unless the similarity between the situations was perceived. Children do not perceive similarities unless these have been pointed out, and behavior which has functioned in one situation may not appear in another because no similarity is felt. We say to the child, "You must obey your nurse as you obey your mother," and the transfer between the situation "command by mother" and "command by nurse" is made. Similar phrases should be used to bridge the gaps between experiences which a child left to himself never bridges. We say, "This is a dog, but this is a strange dog. We play with our dog; strange dogs we let alone." We have helped the child to analyze the elements in the situation to see those which are similar and those which are dissimilar. To our own dog we react with petting and play; to the strange dog we react by ignoring him. Constant training in such analyses of elements is necessary if thinking is to go on correctly.

Giving an Example of Clear Thinking. The model set may, to some extent, influence learning in any field. If we have before us models of poor writing, incorrect speech, *gauche* social behavior, these models set patterns which we acquire. Constant contact with individuals who use irrelevant details to gain their points, who never follow through a train of thought, who are inaccurate as to the facts brought in, who purposely twist truths, and who jump to conclusions without testing these conclusions, has an effect on the thinking

process in early childhood which may be traced in the responses of individuals in later life. One cannot be irrational in one's words and in one's acts in dealing with children and expect the children to think clearly and to respond in terms of clearly thought-out and accurately verified conclusions.

Helping a Child to Check on His Conclusions. This has a pedantic sound, but by it is simply meant the sort of thinking which the adult does when he says, "Let's see if it will happen that way," and then discusses the possible bearings of the hypothesis. One takes the child to the box and says, "No, a large bear cannot be kept in this small place," or one says similarly, "But if we wear this dress today, it won't be fresh for tomorrow, because dresses in which we play get mussed and sometimes soiled," when the child has said, "I can wear the dress today and tomorrow too." One is constantly checking on false conclusions by bringing to bear on the problem the facts which a more mature experience has provided. Many lessons and occupations are planned to administer checks automatically. "The answer" in arithmetic, "the grade" in the true-and-false examination, such tests as Bonser's tests of reasoning are all planned to check the correctness of conclusions. Similar types of checks are put in by certain of the materials in use in the nursery school. These checks, since the process itself in early childhood involves a large element of motor response, are likely to be checks on later action; *e.g.*, if with the Montessori cylinders a small cylinder is placed in a hole too large for it, the work cannot be completed until the cylinder has been removed from the wrong hole and placed in the correct one.

The main points to be kept in mind in connection with the reasoning process are:

1. The reasoning process of children is likely to be inadequate because of lack of experience, inability to keep an end in mind, inadequate ideas, unwillingness to wait until all the facts are in, a memory process which functions neither so quickly nor so accurately as it will at maturity, and a tendency to find similarities where none exist, and to overlook similarities apparent to the better trained and more experienced observer.

2. Education in early childhood involves training in logical thinking, and such training should be undertaken much as is training which establishes the right motor habits and the correct social attitudes.

EXERCISE

Give illustrations of reasoning in your subject.

Analyze these illustrations with a view to finding out which instances of reasoning were adequate and which inadequate.

Give at least five illustrations of reasoning which brought the child to an incorrect conclusion. Show where the reasoning was at fault and give definitely the causes which you would state produced this faulty reasoning.

Compare the behavior of your subject with that of a group of children of the same age.

Draw conclusions as to the reasoning ability of children of the age studied.

Bibliography

1. ALPERT, AUGUSTA: "The Solving of Problem Situations by Pre-school Children," Teacher's College, Columbia University, Contributions to Education, No. 323, 1928.
2. BRAINERD, PAUL P.: "The Mentality of a Child Compared with That of Apes," *Journal of Genetic Psychology*, **37** (2): 268–293, 1930.

3. Carr, H. A.: "Psychology: A Study of Mental Activity," Chap. IX, Longmans, Green and Company, New York, 1925.
4. Cleveland, Elizabeth: "Training the Toddler," Part III, J. B. Lippincott Company, Philadelphia, 1925.
5. Dewey, John: "How We Think," D. C. Heath and Company, Boston, 1910.
6. Kofka, Kurt: "Psychologies of 1925," Part III, pp. 129–145, Clark University Press, Worcester, 1926.
7. Kohler, W.: "The Mentality of Apes," trans. from 2d rev. ed. by Ella Winters, Harcourt, Brace and Company, London, 1925, and New York, 1927.
8. Piaget, Jean: "Judgment and Reasoning in the Child," Harcourt, Brace and Company, New York, 1928.
9. Rasmussen, Vilhelm: "Child Psychology," Vol. III, Alfred A. Knopf, New York, 1923.
10. Stern, William: "The Psychology of Childhood," Chap. XXVIII, Henry Holt and Company, Inc., New York, 1924.

LANGUAGE, DRAWING, AND OTHER FORMS OF EXPRESSION

IF CHILDREN ARE TO ADJUST UNDER THE CONDITIONS which modern civilizations present, they must have an adequate supply of word forms with which to communicate and to receive ideas, and an adequate supply of verbal symbols in terms of which thinking may be carried on. The words which make up the vocabulary must also have as meaningful a content as can be secured. The possessor of a very limited vocabulary is by this fact alone limited in the extent to which he may profit by the experience of others, since such experiences are chiefly, if not wholly, communicated in terms of words. He is equally limited in his capacity to adjust to relatively simple situations.

Nowhere is this more obvious than in the behavior of young children. Commands are misinterpreted because many of the words used are unfamiliar, or directions which seem to the adult perfectly clear are comprehended so little that children may actually do the very things that one would least wish to have done. Misunderstandings between children and adults and between people of equal maturity are all too often the result of misinterpretations or misunderstandings of oral or written speech. The misunderstandings

may be due to a too limited vocabulary or to an insufficiently meaningful content in the words with which one is familiar. The importance of the first four years of life in the acquisition of word forms and in the attitudes which may be developed in regard to finding out to the fullest extent the meaningful content which these may carry cannot be overestimated.

The whole adjustment to society is dependent upon the degree to which the child has attached adequate meanings to words and the degree to which he comprehends the vocabulary of the individuals with whom he comes in contact. It is only necessary to note the number of times that a bill is passed without comprehension by the voters, only to cause infinite difficulty at a later date when its full meaning is comprehended, to see an illustration of this point. A committee chairman with an adequate and meaningful vocabulary is capable of directing the behavior of his entire committee and perhaps group without their being aware of the goal toward which they are tending.

The number of instances in which children misinterpret is legion. Many of the so-called "funny" stories are illustrations of this point. From a long collection the writer selects these as illustrations.

A little girl who had just entered kindergarten was told to go to the side board. She made no attempt to go, so the command was repeated but again without results. A third repetition brought a flood of tears and the statement, "But there is no sideboard in this room."

A three-year-old was told to stamp his feet and get them warm. The command was repeated four times. The child's state of tension increased steadily and at the fourth com-

mand he had a temper tantrum during which he stamped his feet violently. The director who had given the command pointed to his feet and said, "Now you're stamping. Now your feet are going up and down and you're stamping." The tantrum stopped and the child said, imitating the act, "Now I'm stamping . . . up and down . . . stamping up and down."

Children's misinterpretations of religious teaching are not only the cause of laughter but may produce severe behavior problems. A nursery-school child four years of age began to use escape mechanisms of all kinds though he had used them infrequently up to that time. He stated that he was a giant and that nothing could touch him. Then he became Superman. Finally he stated that he was an express train that nothing could stop or catch up with. After long observation of his play and some discussion, it was discovered that his Sunday school teacher had told him that God and Jesus were with him watching over him always. Shortly after, she stated that children should be good so that they would please God and Jesus. The combination was too much; the little boy, afraid that God and Jesus were watching him all the time to make him be good, instead of allowing him to act in a natural manner, attempted to escape from a life that had become too burdensome by pretending that he was something or somebody that could not be reached, influenced, or caught up with. Note the choice of Superman, a giant, and a high-speed express train as escapes. In addition to attempting to escape, he also tried to effect a compromise by drawing pictures, making clay objects, and painting things "for God so He'll be good to me." Mature experience, plus an adequate comprehension of vocabulary, would have avoided what appeared to be the inception of a

serious behavior difficulty and a series of attitudes toward religion which might influence his entire life.

Language. According to Stern (12), children pass through clearly defined stages in the development of language control.

1. Preliminary period (to the end of the first year): Babble, mere imitation of sound forms. During this period the child understands requests.

2. The first period (from approximately one year one month to one year and six months): Mastery of single-word sounds. In this period, Stern states, "word pictures and active sound expressions are most prevalent." This is the one-word-sentence stage.

3. Second period (from approximately one year and six months to two years): The child passes out of the stage of the one-word sentence and begins to combine words. "Awakening of the consciousness of the object of speech (that everything has a name) and the will to master it."

4. Third period (from two years to two years and six months): "Complete mastery of uninflected speech. Questions refer to names of things, where, what, information and personal sympathy."

5. Fourth period (from approximately two years and six months to four years): Rapid growth in the use of subordinate clauses and finer differentiation in speech forms. During this period, the child asks innumerable questions of the "why?" types. He is interested in relations both temporal and causal.

Stern's classification of the periods of speech appears to be a true expression of the stages of development through

which the child passes in gaining control over language forms and of the approximate time at which these stages are reached.

There is a preliminary period which appears to last in most children through approximately the first year. During this period, the child engages in vocal play which becomes more and more complex in character. Both the number of sounds which can be made and the combinations of these sounds increase.

Fenton (5) quotes from Miss Shinn an account of the way in which Miss Shinn's niece developed words out of certain of the babble sounds.

The little girl, as she came to ten months old, was a greater chatterer than ever, pouring out strings of meaningless syllables in joy or sorrow, with marvelous inflections and changes—such intelligent remarks as "Ne-ne-oom-bo," and "Ga-boo-ng," and "A-did-did-doo," and certain favored syllables over and over, such as "Da-da-da." In the last four days of the tenth month we began to suspect a faint consistency in the use of several of the most common sounds. We began to think something like "Da!" (varying loosely to "Ga!" or "Dng!" or "Did-da!" or "Doo-doo!" but always hovering round plain "Da!") was suspiciously often ejaculated when the little one threw out her hand in pointing, or exulted in getting to her feet; that "Na-na-na!" was separating itself out as a wail of unwillingness and protest, and "Ma-ma-ma!" as a whimper of discontent, and loneliness, and desire of attention; while—nearest of all to a true word—a favorite old murmur of "M-gm" or "Ng-gng" recurred so often when something disappeared from sight that we could not but wonder if we had not here an echo of our frequent "All gone."

All these sounds were used often enough at other times, and other sounds were used in their special places; yet week by week the note-book showed "Da!" growing into the regular expression of discovering, pointing out, admiring, exulting; "Na-na-na!" into that of refusal and protest; and "Ma-ma-ma," which soon became "Mommom-mom,"

into that of a special sort of wanting, which slowly gathered itself about the mother in particular. I do not think that these were echoes of our words "There!" and "No!" and "Mamma"; it was only slowly, and after the baby was a year old, that they came into unison with these words, and in the case of "Mamma," not without some teaching. It is more likely that we have here a natural cry of pointing out, a natural negative, a natural expression of baby need and dependence, which give us a hint of the origin of our own words. . . .

The baby begins slowly to turn some of his commonest chattering sounds to special uses, not to carry thought to other people, but as mere exclamations to relieve his own mind. . . . And most of the exclamations express a mood rather than a real idea; they are halfway between mere cries and words proper. Even when there is plainly an idea, as in "All gone," it is a big vague blur of an idea, slowly taking form in the little mind, as the blurs of light and dark slowly outlined themselves into objects before the little eyes months before.

Certain sounds are selected out to be repeated and practiced because of the fact that these appear to produce results. The sounds are at first made purely accidentally, and are most often selected by the fact that the adult acts upon them as though they were commands, and thereby builds up in the child's mind the relation between a sound and some action or object. If one will make the "ah" sound, and then, as the sound is being produced, will close the lips and open them more or less rapidly, the resultant will be a series of words sounding like "mama." The pleasure of the adult at this sound is sufficient to make the child practice it, particularly as the adult sounds it back to the child, and thereby deepens the impression made. The child imitates the sound made by the puppy and finds that the imitation of this sound when the puppy is absent may result in having the puppy brought to him. He is thus preparing for the second period, at which time he becomes aware that everything has a name.

Progress in the one-word stage of development, the first stage which begins at approximately the end of the first year, is rapid where there is someone at hand to select the sounds which approximate names of objects or individuals, to make the production of such sounds pleasurable by producing the objects they describe, and to sound them back to the child. In the first period, there seems to be interest in the result produced by the sound forms, but it is not until the second period is reached that there appears to be a clear perception that everything has a name. In the so-called "naming stage," children appear to be fascinated by the mere pointing at objects with some form of demand that the name of the objects be told. Stern states of his little girl Hilde that "the writer has often observed children fascinated by the game of pointing to each object an adult is wearing, and naming each object as it is pointed to." Where the adult supplies both a wide range of objects and the time necessary to name these objects, the child shows a marked acceleration in the development of the size of his vocabulary. From this time on, there is a constant substitution of words for activities. Originally, when the child wished a particular toy, it was necessary for him, provided he possessed the ability to walk, to go to the place where the toy was kept, and point to it. Now, as a substitute for this long series of movements, he needs only to use the single word which is the name of the toy desired. Heretofore, if hungry, he would have little ability to express the cause of his discomfort to the attending adults. His responses, when he was uncomfortable for reasons of any kind, could have been but little more than a cry, though the cry could differ but little from the cry that he made when his discomfort was caused by pain. From now on, he will be able to demand

the object which will satisfy his needs, or cause a cessation of the specific discomfort from which he is suffering.

From approximately one year and six months to two years, there is a rapid growth in the use of the two-, three-, and four-word sentence. The period in which nouns were used almost exclusively is now left behind, and the child makes much use of the noun and its verb, but without much use of qualifying words. Stern states (12):

> The vocabulary of a normal girl shows roughly the following divisions, interjections not being considered: at the age of a year and three months, substantives 100 per cent; at the age of a year and eight months, 78 per cent substantives, 22 per cent verbs; at the age of a year and eleven months, 63 per cent substantives, 23 per cent verbs, 24 per cent other classes of words.

In the third period, the child develops a greater freedom in language. He has passed out of the stage of uninflected speech, but there is still wide room for development. The child's vocabulary is small, and he comprehends but poorly words and phrases as they are said to him by adults. He can now express his wants clearly by the use of nouns and verbs, but the way in which these occur often necessitates interpretation by some adult who is familiar with the child's word forms. A quotation from Stern's account of Hilde is illustrative of the confused order in which the words occur: "Mama—wanty pickies—room—wanty pickies—back—dada—mama fetch." This sentence was intended to express a wish for her mother to bring to her some pictures which were in a back room. During this period, children frequently ask questions, but there does not seem to be anything like the number or variety of questions which there will be when the child passes into the fourth period of speech.

In this period, from approximately two years and six months on, the child appears to ask the question "why?" continually. "Why does the man go down the street?" and if this is answered, "He is going to the grocery," it is followed by "Why does he go to the grocery?" and this is followed by innumerable questions as to what he buys there and as to the use to which the things which he buys there are to be put. These "why" questions should be answered as fully as possible if children are to learn the meanings of situations and of the words in which these may be described. The world in which the young child lives is much too complicated for him to find out what he wishes to know through his own exploration and experimentation. He can learn only if his questions are answered correctly and in as much detail as he can comprehend. A four-year-old of the writer's acquaintance on being told the story of "the turtle whom nobody liked because he talked and talked and talked," said, "Oh, does he ask 'why' too?" For this child, questions apparently constituted a reason for not being liked. The effect of this attitude on seeking information through the medium of language is obvious without further explanation. During this period, from two years and six months to four years, and the period which immediately precedes it, children are exceedingly interested in any activity which concerns themselves and in every object with which they come in contact. They are fascinated by very short jingles; but stories which involve more or less intelligent continuity and a fairly mature experience, such as "The Three Bears," appear to make little appeal to them. They are fascinated by stories which deal with their own activities. One may begin a story about how John got up out of bed in the morning and put on first one stocking, then the other stocking, and then one shoe and then the other shoe, and then

put on his underwear, and so on, until he is completely dressed. One may continue the story by telling how he goes down to the table to his breakfast, and how he eats every portion of it, and the child will listen with great interest. He still follows the story fascinatedly. Such stories as those contained in the "Here and Now Book," by Lucy Sprague Mitchell, though simple in character and extremely uninteresting from the point of view of the adult, hold the attention of children in the third and fourth periods of speech development when the more complicated stories hold their attention but little.*

At any stage there may be a rest period, a "plateau." This may be due to a shift in interest, inasmuch as Fenton states (5):

> Most observers have found that such periods are marked by rapid progress in some other ability, usually walking, standing, running, or climbing, and the like. This would seem to suggest that the explanation lies simply in a temporary shifting of the child's interest and attention to other matters. We have already noted the eager, absorbing interest with which a baby devotes himself to the practice of every newly acquired stage in sitting, creeping, walking, etc., and this lends weight to such an explanation.

The writer would account for the rest periods in the acquisition of language both in the terms in which they are accounted for by Fenton and in the terms in which similar periods are accounted for by Bryan and Harter (2) in the learning of the telegraphic language. Bryan and Harter account for the plateau on the basis that learning proceeds

* For the effect of social grouping and play on language see S. Q. Janus, "An Investigation of the Relationship between Children's Language and Their Play," *Journal of Genetic Psychology*, **62**: 3–61, 1943, and R. M. Williams, and M. L. Mattson, "The Effect of Social Groupings upon the Language of Preschool Children," Child Development, **13**: 233–245, 1942.

by development of a hierarchy of habits. A summing up of their position is as follows:

> A hierarchy of habits may be described in this way: (1) There is a certain number of habits which are elementary constituents of all other habits within the hierarchy. (2) There are habits of a higher order which, embracing the lower as elements, are themselves in turn elements of higher habits, and so on. (3) A habit of any order, when thoroughly acquired, has physiological and, if conscious, psychological unity. The habits of lower order which are its elements tend to lose themselves in it, and it tends to lose itself in the habits of higher order when it appears as an element therein.
>
> A plateau in the curve means that the lower-order habits are approaching their maximum development, but are not yet sufficiently automatic to leave the attention free to attack the higher-order habits. The length of the plateau is a measure of the difficulty of making the lower-order habits sufficiently automatic.

In the acquisition of oral speech, one must have not only a sufficient number of words to carry on thinking, but also adequate coordination of the mechanisms involved in the production of words. A glance at the number of mechanisms involved will show how difficult it is to set up reactions in such sequence that all the mechanisms involved in speech will be called into play in the order and at the rhythm required. When vocal sounds are produced, the muscles of the diaphragm are called into play, as are the muscles of the ribs. The thorax, the lungs, and the trachea must be operative and there must be movements of the vocal cords. The position of the lips, tongue, and palate must also be such as to give the correct form to the words and to produce the correct tone. When the muscles of the diaphragm are cramped in their movement, speech is interfered with. It is also interfered with when the lips do not move freely, when the tongue does not help in the formation of words, when the breath is not let out during speech at the correct rate,

and so on. Breathing occurs at different rates for periods in which no speaking occurs and speaking periods. If one realizes that all these organs, beginning with the lips and going downward as far as the abdominal walls, are involved in the production of correct speech, one realizes how many minor habits go into the motor adjustments required.

Where the child's speech cannot keep up with his ideas because he is tired or for some other reason, stuttering often occurs even in normal cases. Relaxation and rest with no attention called to the stuttering are often enough to obviate what might become a bad habit. Ridicule or fear associated with this stuttering is sometimes sufficient to produce a stutterer where the same child would have spoken normally had there been no emotional interference with speech.

After a long illness, during periods of fatigue and physical strain, after emotional upsets, in fact after severe disturbances of any sort, stuttering may appear for a brief period and then disappear without leaving any trace in the speech behavior of the child.

In addition to the necessity for acquiring motor habits before speech can proceed at the normal rate, there is also the necessity, as has been said, for the acquisition of numerous speech forms. Plateaus may occur at any period during the acquisition of these forms. A few words may be learned and then a large amount of practice may be necessary in order to acquire further words. To progress to the second stage in speech, the two- or three-word sentence, one must have practice not only in the use of single words, but in the use of such words in combinations in the right order, or at least in so combining them that their meaning is clear.

A rest period may occur in the one-word sentence stage, because the extra words must be acquired before one can progress to the second stage. A second rest period may occur in the second stage while the child is beginning to combine words, on account of the fact that he needs additional word sounds and needs to practice these in meaningful combinations. A plateau may occur in the later stages again because elements of the larger speech habit need practice to bring them to the point at which they will function automatically as a part of the whole language unit. Swift (13) gives the following statements in regard to the acquisition of a foreign language:

> Americans who spend several years in Germany pass through a long period of discouragement. Though they study the language faithfully and avail themselves of every opportunity to practice conversation, they seem to make absolutely no progress. The length of this plateau period varies with different persons, but all experience its oppressiveness. Now the most curious feature of this plateau, aside from its overpowering monotony, is the suddenness with which it finally disappears. Several have told the writer that they went to sleep one night unable to understand anything, as it seemed to them, and utterly discouraged, and awoke the following morning to find that they had mastered the language, that they could understand practically everything that was said to them. The word associations and national peculiarities of thought sequence had been automatized during the long period when no visible progress was being made.

This probably has its parallels in children's acquisition of language forms. In order to help the child to progress beyond the plateau period, he should have both a large opportunity for practice and incentives which will make such practice interesting. In general, if the child is allowed sufficient freedom, the delight in the language forms themselves and the parent's delight in each new word which the child acquires furnish sufficient incentive.

There are certain peculiarities in the growth of language which should be pointed out, together with activities which appear to result in a speeding up of the acquisition of language. A large proportion of children stutter at least twice between the ages of eighteen months and four years. A much smaller proportion, not more than 10 per cent, stutter once more. The first stuttering appears during the progress from the one-word stage of speech to the use of sentences.

The stuttering may be severe, but, if properly treated, it disappears within three to six weeks. No adult should ever make a child slow down the natural rate of speaking or repeat again and again the words which he has stuttered. On the contrary, no attention should be paid to the stuttering. It will pass when, and only when, the child has had adequate practice with the use of three-, five-, eight-word and longer sentences. To attract the child's attention to the stuttering is merely to prolong it, sometimes to the point of fixing the stuttering habit permanently. Fortunately, the average busy mother or nurse pays little attention to the appearance of stuttering but welcomes new words, longer sentences, and so on. A one-child parent or an overconscientious one or a nurse who is not kept adequately busy may fixate on the stuttering and thus fix it as a permanent pattern.

The second stage appears usually somewhere between four and five, though it may appear slightly earlier in superior children. When this occurs, it is more apt to be attended to by the adults who have the child in charge and therefore more apt to be made permanent. Its probable cause is the preponderance of ideas over speech, *i.e.*, the child has more ideas to express than speech with which to

express them. Here, again, practice is important, for with the addition of a few more words and sentences this phase also passes.

The third period in which stuttering may occur is immediately before or after the child's entrance into kindergarten or school where, again, experience outweighs vocabulary. The same treatment should be used here as was employed during the two preceding periods. If the stuttering persists during the sixth year, treatment should be instituted but *not* by the parents or other interested relatives or friends. A specialist should be consulted and his advice followed.

There are factors in addition to plateaus which in themselves predispose to the slowing down of the acquisition of speech. Children who do not have the maternal or nurse interest which results in the adult's sounding back to the child any sound which approximates a word may be delayed a year or more. Institution children are an excellent illustration of this, but so, also, are neglected children in so-called "good homes." The one-word-sentence stage of speech is essential for later development, inasmuch as unless the sound is selected for the baby he cannot select it for himself from the confused babel which he hears about him.

Twins, on the other hand, do not lack practice but do lack proper selection. A delay of six months in their case is usual, but this is not actually delay in the acquisition of language. They select for each other sounds which both comprehend and develop in the process a "twin language." This is excellent for the purpose of communication as far as they are concerned but bars out completely anything outside of their twin world.

The acquisition of language is a long and hard process. It involves an infinite number of muscular and cortical adjustments. It requires long practice and great discrimination. If there is a way to make this process shorter, the individual will develop it. The twin language is usually a sample pattern of sound and gestures which the children select. This does away with the necessity for practicing a more complicated series of language adjustments which adults have selected.

Many enter school with a well-developed twin language and a poor command of English. A pair of twins entered kindergarten with few words. They looked the room over, fixed their eyes on the teacher, and began to communicate with each other rapidly. At the proper points they shouted with laughter. The puzzled teacher allowed this to go on until she realized that she was the object of the too humorous comments. The twins were isolated one on each side of the room, only to communicate by hand, body, and facial adjustments. This continued for two days, until the teacher called upon the mother for help. For the first time in their lives the twins were spanked; and the twin language stopped in school but continues today fifteen years later. It has become even more complex. The twins are now separated, one in the navy and one in the army, so it is possible that a portion of their well-developed language will disappear. Triplets may show a year of retardation in regard to language acquisition and still be entirely normal.

There are other reasons why the process of acquiring language may be slow or may not occur. A spoiled child who never has to talk may delay speech until the fourth year. If there are older brothers or sisters who wait on the child or adoring adults who never make it do more than

point or cry when it wishes an object or food, language may not be acquired until the child reaches school. By this time he is too old to acquire the patterns in the natural manner and the delay may be permanent.

The child may be deaf and therefore not hear word sounds, or—the most serious cause of all because it is least to be remedied—the child may be delayed mentally.

The acquisition of language parallels roughly the development of intelligence; feeble-minded children may therefore acquire language a year or more after the usual time.

There is a peculiarity in the development of language which the writer has seen only in children with intelligence quotients above 135. Children of high intelligence levels occasionally begin to speak fluently with the proper inflection and pronunciation but without using more than one or two English words. At a distance it sounds like well-coordinated speech. A conversation may last twenty minutes and in the entire time not more than three to five English words be used. The child will accept any opportunity to practice but will definitely not speak English until two and a half or three years of age.

The transition is difficult to observe, but apparently suddenly English speech with full sentences will appear. One such subject had appeared not to use an English word until he reached two years and nine months of age. One morning he stepped off the elevator and said, "Where's my locker? I'd like to hang up my coat." When the children gathered for the news circle, he took the leadership from the teacher, gave the finger plays with proper words, and ended with "That's enough, let's sing." He followed this by singing, off key and without the proper rhythm, the

correct words for all the songs. Until this behavior occurred he had used no English words. Precocious mental development is indicated by precocity in the development of language forms. A baby observed by the writer, at the age of nine months, said clearly to her father, "Daddy, bring dolly Mary." When her father returned to the room, she said, "Where Mary dolly?" Had this been reported to the writer, there might have been doubt of the occurrence, but it was observed. This same girl later tested 185 on the Stanford revision of the Binet test.

Increase in the size of vocabulary has been studied by many authorities. Smith (11) has developed an excellent vocabulary test for children. She presents a table showing the increase in size of vocabulary with increasing age. The mean number of words at one year is 3; at two years, 272; at three years, 896; at four years, 1,540; and at five years, 2,072. There appears to be an increase of over 500 words per year between age two and age six.

These figures do not agree completely with those of Nice (9). She states that a child of one year has an average vocabulary of seven words, and at eighteen months of seventy-one. Since the selection of her cases may be criticized, it is wiser to accept the results of Smith as a standard.

There is not only an increase of the size of vocabulary with increasing age. There is also an increase in the meaningful content of words. If one takes such a simple word as "chair," one can see it go through a wide change as a child matures. At first, the word signifies to the child only the chair in his nursery. Later, it comes to mean dining-room chairs and chairs in other rooms in the house, upholstered chairs, and plain ones. It may come to represent different chairs in history just as did the spoon in our earlier illus-

tration, and in the end, it may come to have a meaning far afield from the original one, as capital punishment—"Sending a man to the chair." It may also represent a professorship in a college, as "He occupies the chair of History." The simplest words go through these changes in meaning. With each added experience for which the word stands, the word itself becomes richer in meaning.

The number of ideas, objects, and situations suggested by such a simple word as "run" would occupy pages if one were to write them down, *e.g.*, "the run of a train," "athlete's run," "run" representing a brook or stream, and the like.

The acquisition of vocabulary on the part of the child, therefore, involves an enormous amount of learning, all the way from the acquisition of those motor coordinations which will result in pronunciation of the word with the correct accent and intonation to the growth of meanings which the word may carry. Meanings grow by analysis and by synthesis. "Goodness" to the young child means to obey, to pick up his toys, and similar simple adjustments. The very things which the young child gives as meaning for a word may be the ones which the adult will eliminate. No adult will define "goodness" as obedience to those who speak to you, or putting away of materials out of place, or the like. If he did, few adults could be said to possess that quality.

The child adds new meanings to the word as he eliminates old ones. As he drops out his earlier interpretations of "goodness," he substitutes those of the more mature mind and in addition adds constantly to the series of activities for which the word stands. All words undergo these changes as children mature.

There appears to be a fair correlation between intelligence and the acquisition of vocabulary. Terman (14) places great stress on the vocabulary test in the Stanford Revision of the Binet test. Not only is the acquisition of new words measured in all types of intelligence, but the ability to remember sentences is also a part of most standard test series.

Gesell (7) gives credit at the four months' level for laughing aloud and responding vocally when socially stimulated. At nine months, credit is given if the child says "Dada" or its equivalent and if he listens with some evidence of selection to familiar words. At eighteen months, "the child says five or more words, uses jargon conversationally, points to nose, eyes, or hair." At two, the child can be expected to name objects.

Terman (6) has, as one of the six tests at Year III, the repetition of six to seven syllables in a sentence (*e.g.*, "I have a little dog"); at Year IV the child gets credit in an alternative test for repeating twelve to thirteen syllables in a sentence; and at Year VI, credit is given for the repetition of sixteen to eighteen syllables in sentence form.

Instances of the use of language maturity as a measure of intelligence are increasingly frequent as one goes up the years in the scale of tests.

There seems to be no clear difference between the sexes as to rate of language development. Terman finds that girls increase in language development at a greater rate than do boys. The difference, however, appears not to be very great. Smith (11) does not point out any clear relationship between rate of development and sex. A study by McCarthy (8) indicates a slight superiority of girls over boys.

The data on the relations of social status to language maturity appear to be much clearer in their implications. Anderson (1) states that the McCarthy data "indicate that the difference between the mean of the upper three occupational groups and the lower is the equivalent of ten months in age. Between the extreme groups the difference is of course very much greater. Hetzer and Reindorf, comparing professional-class and laboring-class children find retardation in extent of vocabulary nine to twelve months, sentence usage four months, first employment of inflection four months, and in the use of different parts of speech six months." Stern (12) states that the difference between educated and working-class children in language acquisition amounts to approximately eight months.

To summarize, language proceeds through the acquisition of control over all the mechanisms involved in vocalization, through increase in the size of the vocabulary, through increase in complexity in the use of words, and through the acquisition of richer meanings to those words already in the vocabulary. It also proceeds through the development of discrimination in the use and meaning of word forms.

At the same time that the child is developing language of a verbal sort, he is using a system of gestures, which both assist in the formation of word forms and are of value in themselves as giving indications of what he wishes. These gestures tend to be supplanted by words as the child gains more and more facility in the use of word forms. Many of them tend to drop out as the child matures, but very gradually. Some gestures persist throughout life, though society seems to put a certain amount of pressure into suppressing many of them, *e.g.*, such gestures as pointing toward objects of interest.

Drawing. According to some authorities, the child passes through much the same stages in his drawing as in his acquisition of speech. The first stage of development Meumann calls the "scribbling stage," because there appears to be no definiteness in the figures which the child has drawn. They consist of mere movements to and fro of the pencil, without outline and without resulting in any delineation of an object which can be recognized by anyone but the child himself. Sometimes whole pages will be covered with zigzagging pencil marks. Any attempt to copy objects even simple in form results in scribbling of the type described above. The outline of a square which the child attempts to copy is, more often than not, represented by a number of pencil strokes without any connection between them, or by a few small zigzagging lines.

The child appears to pass out of the scribbling stage in drawing, in the same way that he passes out of the babble stage in speech, *i.e.*, by realizing that some of the things which he produced bear resemblance to common objects. One boy, aged three, was observed to make a number of upward and downward strokes upon the paper, much as if he were making a large writing stroke. The scribbling bore a vague resemblance to the outline of an airplane. This resemblance the child noticed, and exclaimed over. For some time after this he derived much pleasure from making copies of the first so-called "airplane."

The child's drawings become more and more outlined in form as he matures. This second stage in the acquisition of drawing, *i.e.*, the stage in which the outlines of objects are made, is called by Kerschensteiner (19) the "sketch stage." While in this stage, the child represents objects as he knows them to be and not as he actually sees them. He will draw

both eyes, the whole mouth, and the nose when he draws a profile. If he represents a house, more often than not the chairs, the table, and the other objects in the house show through the walls. One four-year-old produced a sketch of a house in which he showed in the four corners of a rectangle, a mantelpiece, a bed, a kitchen stove, and a duck, a toy of which he was particularly fond. Those four objects represented the four strong points of interest to him in his home. All less interesting objects were omitted from the drawing, but these four objects were not only visible through the walls of the house as drawn, but occupied almost the whole space enclosed in the four lines which represented the outside walls of the house.

The tendency to select for drawing and to enlarge those objects which arouse the child's interest is clearly visible in any series of drawings of children of preschool age. If the child is particularly interested in buttons, the outline figure of the man which he draws is often covered with large circles, representing buttons. If he is interested in fingers, as so many children are, he pays little attention to outlines of the figures of the man or woman he is drawing, but he will make so many fingers on the hands that they look like the representation of the rays of the sun. Sometimes in the sketch stage the child will use a single outline form to represent all objects in the same class; for example, Kerschensteiner is reported by Rasmussen (22) as stating that

> . . . More than 50 per cent of six-year-olds produce no alternative "sketches" for animals, but use the same one for all of them; indeed about 10 per cent even use the human sketch when drawing an animal. Of 138 six-year-old children who were set to draw a horse, a dog, a cat, and a duck in the order named, not one used more than one sketch.

Rasmussen states that his observations of children's drawing coincide in a measure with the experience of

Kerschensteiner, but not wholly. He goes into a detailed development of drawing in the case of his own child R.

> Until the age of two, R drew without the least resemblance to the model both as regards substance and form. When R was two years old, her drawings began to resemble realities slightly. She put, for example, a circle in the head of a girl and called it an eye. Her girls also had arms and legs. . . . When three years old, she drew a flower and a fish and there is some substance besides a slight resemblance as regards form; but the latter resemblance is probably due to the fact that such objects cannot be remembered otherwise than with respect to their form.

Rasmussen states that R's fish shows the shape of the animal, but that the drawing of the flower was "almost entirely flower pot." R did not employ the same sketch for different animals. She had a number of sketches to represent the different animals. For example, her tiger was entirely different from her duck. R's pictures of persons became more and more detailed. To her pictures, she added hair, ears, and finally boots. She drew faces in profile with nose, mouth, and chin, and even a neck. Rasmussen states, however, in the case of R, that the variation from the figures studied by Kerschensteiner was probably due to adult interference. Neither R nor any of the other children who have been studied seemed to have a sense of perspective during the nursery-school period. R's drawing, which Rasmussen characterizes as "an illustration of a story," is sufficiently interesting to be reproduced.

The drawing reads from the top downwards. It shows

> . . . a man who won't move out of the way of a motor car. Then a bicycle comes along and runs over him. Below him stands a man who is astonished that he won't move. Inside the room (the triangle, perhaps meant to represent a bow-window) stands a man looking on. And in the room are a table and a chair.

FIG. 14.—(*Reproduced by permission of Alfred A. Knopf, Inc., from "Child Psychology," by Vilhelm Rasmussen.*)

The picture is given here, because it represents so many of the characteristics of children's drawing which have just been enumerated. In the first place, there is the outline form without regard to perspective and size, which is so characteristic of drawings of children of this age. This appears in all of the figures, but is particularly apparent in the figures of the two human beings as compared with the other objects. The boy is almost as large as the automobile, while the man is much larger. The man in the bow window is so large as to project out of the lines enclosing the house. The table and chairs are clearly seen through the walls of the house, another of the characteristics pointed out previously.

Children pass very gradually out of the sketch stage and into the stage in which they draw objects which are really reproductions of things as the mature individual sees them, that is, things which are correct in size and detail and which show a knowledge of perspective. During the nursery period, the child passes through the scribbling stage and into the sketch stage, but he does not pass out of the sketch stage until some time after he has reached school age.

Goodenough (17) appears to think that drawing is an excellent indication of intelligence and may in fact be used as a measure of mental maturity. There appears to be some basis for this view-

point. The level of maturity in drawing does not appear to be so indicative as does maturity in the field of language, nor is it so good an index of average behavior. Drawing, like music, appears to be one of the special abilities influenced more by hereditary predisposition than by the degree of maturation. Perception of form and capacity to reproduce simple forms such as the square, the diamond, and the circle do appear to be measures of intelligence and are included in most mental test forms. The ability to draw a circle is present at the end of the second year of life, though the circle is somewhat sketchy in its outline owing to the poor coordination of the infant (14). The ability to draw a square appears at year four, and the ability to copy a diamond at year seven. The only drawing test which appears to have been adapted by Terman as a part of his theories of tests for young children is a completion test and not drawing per se. At four years and six months (14) a child is supposed to complete a bird so that it is easily recognizable.

A number of experimenters, including Hurlock and Thomson (18) and McCarty (21), have studied the subjects which kindergarten-age children choose to draw. McCarty concludes that children prefer the human form first—16.5 per cent of 30,000 children—and next houses—13 per cent of her subjects. Hurlock and Thomson (18), using an entirely different method, *viz.*, asking the children to draw pictures of eight objects—a man, tree, girl, house, dog, flower, automobile, and boat—found that they used color whenever they could. These experimenters also found an increase in the use of detail surrounding the main objects of the drawing. This has also been pointed out by Rasmussen.

The experimentation in this field is still inadequate both as to the exact stages through which children progress and as to the acquisition of definite techniques. It is still wiser to accept the parallel stages between the development of speech and the development of writing than to attempt to evolve additional stages or to draw far-reaching conclusions on the basis of the present inadequate data.

Work with Clay. In addition to drawing as a form of expression, children work with other plastic materials, particularly with clay. At first the objects which are produced bear a strong resemblance to the objects of the scribbling stage. To one small lump of clay they will add other lumps, patting each lump down until they have a large irregular mass which bears no resemblance to any known object except where there is adult interference and where principles of modeling in clay are pointed out to them. They later see similarities between the forms produced in rough experimentation and real objects, just as they do between real things and the forms which they produce in scribbling. For example, in patting the clay, children often make an excellent likeness of a ball or a pie. In rolling it, they sometimes make round objects like balls or elongated objects which they take to represent a piece of rope, a chain, or even a snake or worm. From these relatively simple forms, other forms are developed. Children will push one finger into the mass of clay which represents a ball, and then insist that it represents a pitcher, a cup, or a glass. They will attach four elongated pieces of clay to the round pielike shape, and then insist that they have a "man," or a "lady," or a "dolly." The objects which they reproduce in clay show as rough an approximation to real objects as do their outline drawings in the sketch stage to the objects which

these are intended to represent. Where there is an interested adult whom they can watch making simple forms in clay, children appear to pass more rapidly out of the stage of rough experimentation. They make approximations to real objects like balls, plates, and so on.

Rhythm and Music.* Most young children show practically no ability to carry real tunes before the age of three, but they appear to delight in long songs, delivered in a somewhat monotonous voice. Often the songs consist of nonsense words. Children will sing for a matter of minutes, putting into the song all the objects in the room, the activities of the doll with which they are playing, and other such features of their play. Short songs may be sung very early. Stern (23) states that his son Gunther at the age of one year and eleven months,

> . . . sings a great deal and with evident enjoyment. His repertoire is certainly not very extensive . . . His chief melody is the song, "Hop, Hop, How the Pony Does Gallop," which he sings in two variations. . . . Intervals and key are not quite clearly maintained, yet sometimes the first consecutive thirds of the first variation are perfectly true.

Gunther appears to have had somewhat more ability to keep a tune than is characteristic of most young children, and his father comments on the fact: "The boy appears to be musical. At four years and six months, Gunther could whistle with fair clearness, in fact, more clearly than he sang."

Conception of a tune and words that go with it develops gradually. It is much assisted by the type of song two or three lines long, characteristic of much of the kindergarten work with young children. "Jack Be Nimble, Jack Be

* For recent work see Moorhead, G. E., and D. Pond, "The Music of Young Children," Pillsbury Foundation Studies, II, 1942.

Quick" is an example of such a song. Children learn to recognize the simple tunes and the simple rhythms by the time they are four or five years of age. They can tell you the name of a song when it is played or sung. Drill of the sort in which the child hears a simple song and names it, and then attempts to repeat a series of simple songs which the adults or his parents are supposed to recognize, appears to be helpful in giving the child the ability to recognize tunes and ability to sing them.

Some children appear to be unable to keep a tune, not only in the preschool period, but also in the period that follows. They appear to take great delight in singing in spite of the fact that much of what they sing is wholly off key or in a monotone. There are a number of songs in which children of this type can take part, such as the songs in which a general group of children carry the tune, but in which there is a repeated phrase, monotonous in character, which the child who cannot keep a tune can repeat.

Training in rhythm and music should probably go on at the same time as training in other forms of expression, but it will be found that, except in occasional instances, children in the nursery-school period (up to the age of five or six) can get clearly only the most simple tunes and the most simple rhythms.

EXERCISE

What stage in expression has your subject reached in the development of language?

Discuss fully the type of words which he uses. (For this make verbatim records.)

How far does gesture take the place of words? (Here give concrete illustrations.)

If possible, give several illustrations of the way in which new words have been acquired. Illustrate, also, changes in the meaning of words.

How far does your subject use nonsense words? Give instances, if any such instances have been observed, of the use of nonsense words in long sentences.

If your subject has not left the one-word-sentence stage of expression, trace his development over a period of six to twelve months and note the changes in the use of language.

Show the subject pictures of familiar scenes. Note the use of words in describing scenes. Note particularly any spontaneous expressions.

Compare the subject studied with a group of children of the same age. Note any individual differences in language control. Has your subject less control of language than average? More? Average?

Get samples of your subject's drawing, of his modeling in clay or other materials. What stage has he reached in the use of these materials? Give concrete illustrations to prove your points.

If the subject is to be studied over a long period, note any changes which occur in the use of language and in the use of drawing and modeling materials.

Bibliography

Language

1. Anderson, John E.: "The Development of Motor, Linguistic, and Intellectual Skills in Young Children," Conference of the Committee on Child Development, National Research Council, Toronto, 1929.
2. Bryan and Harter: "Studies in the Physiology and Psychology of the Telegraphic Language," *Psychological Review*, **6**: 348–375, 1899.
3. Day, Ella J.: "The Development of Language in Twins," Ph.D. thesis at University of Minnesota, in Anderson (1).
4. Fahey, George L.: "The Questioning Activity of Children," *Journal of Genetic Psychology*, **60** (II): 337*ff*.
5. Fenton, Jessie C.: "A Practical Psychology of Babyhood," Houghton Mifflin Company, Boston, 1925.
6. Fleming, Virginia Van Dyne: "A Study of Stanford Binet Vocabulary Attainment and Growth in Children in the City of Childhood, Mooseheart, Illinois, as Compared with Children Living in Their Own Homes," *Journal of Genetic Psychology*, **60** (II): 359*ff*.

7. Gesell, Arnold: "Mental Growth of the Pre-school Child," The Macmillan Company, New York, 1925.

8. McCarthy, Dorothea: "The Language Development of the Pre-school Child with Special Reference to Sentence Formation," in Anderson (1).

9. Nice, M. M.: "On the Size of Vocabularies," *American Speech*, **2**: 1–7, 1926.

10. Rasmussen, Vilhelm: "Child Psychology," Vol. II, pp. 53*ff.*, Alfred A. Knopf, New York, 1923.

11. Smith, Madorah E.: "An Investigation of the Development of the Sentence and the Extent of Vocabulary in Young Children," *University of Iowa Studies in Child Welfare*, **3** (5): 1–92, 1926.

12. Stern, William: "The Psychology of Early Childhood," Henry Holt and Company, Inc., New York, 1924.

13. Swift, E. J.: "The Mind in the Making," pp. 217*ff.*

14. Terman, Lewis M.: "The Measurement of Intelligence," Houghton Mifflin Company, Boston, 1916.

15. Terman, Lewis M., *et al.*, "Genetic Studies of Genius," Vol. 1, Stanford University Press, Stanford University, Calif., 1925.

16. Young, Florence M.: "Certain Social Indices in the Language of Pre-school Subjects," *Journal of Genetic Psychology*, **61** (I): 109*ff.*

Drawing

17. Goodenough, Florence L.: "Studies in the Psychology of Children's Drawings." *Psychological Bulletin*, **25**: 272–283, 1928.

18. Hurlock, E. B., and J. L. Thomson: "Children's Drawings: an Experimental Study of Perception," *Child Development*, **5**: 127–138, 1934.

19. Kerschensteiner, "Die Entwickelung der zeehnerischen Begabung," cited by Rasmussen.

20. McCarthy, Dorothea: "A Study of the Reliability of the Goodenough Drawing Test of Intelligence," *Journal of Psychology*, **18**: 201–216, 1944.

21. McCarty, S. A.: "Children's Drawings: a Study of Interests and Abilities," The Williams & Wilkins Company, Baltimore, 1924.

22. Rasmussen, Vilhelm: "Child Psychology," Vol. I, Chap X; Vol. II, Chap. III, Alfred A. Knopf, New York, 1923.

23. Stern, William: "The Psychology of Early Childhood," Part III, Henry Holt and Company, Inc., New York, 1924.

INDIVIDUAL DIFFERENCES IN PRESCHOOL-AGE CHILDREN

ALL CHILDREN ARE QUALITATIVELY ALIKE IN THE SENSE that all possess the physical equipment common to human beings, the same number of eyes, ears, legs, arms, relatively the same number of sense organs, the possibility for growth, and all those activities and tendencies to activity which are common to the human animal. They are quantitatively different in that they vary in the size of limbs, the rate of growth for various parts of the body, the ease of response to sensory stimuli, the ease with which activities are called out, and the degree to which the instinctive tendencies function. These and all other functions and capacities differ from individual to individual. It may well be assumed that there is no single quality, whether it be eye or hair color, or strength of the instinctive tendency to self-assertion, which does not distribute itself in any unselected group quantitatively in the way which is best represented by the normal frequency curve, the curve of normal distribution. According to Gates,* if one were to cut off the extremes of the curve so that the remainder represented 99.63 per cent of the whole area, and were to divide

* GATES, A. I., "Psychology for Students of Education," pp. 411–412.

the base line of such a curve into five equal parts, one would find that in the area on the extreme left would fall about 3 per cent of the cases, in the next area 22 per cent, in the middle area 50 per cent, in the next area 22 per cent, and in the fifth area 3 per cent.

If one were to stand on a street corner in any large city and jot down as they passed the number of individuals with very blond hair, with blond hair, with hair of an average degree of brownness, with slightly darker hair, and with very dark hair, the whole group, if divided into five equal parts, would conform to the averages given above; 3 per cent would have very blond hair, 22 per cent would have hair blonder than the average, 50 per cent would have hair of an average degree of brownness, 22 per cent would have hair darker than average, and 3 per cent would have very dark hair. In the group there would be no abrupt change from very light to dark, but the shades of hair, if they were arranged in order, would vary gradually. The same experiment, if conducted with measurements of the length of the arm or of the height of individuals who would pass, or of the degree to which they appeared to exhibit a sense of humor, would yield approximately the same curve of distribution. All degrees of physical strength or weakness, degrees of fatigability, rate of work, general intelligence, and special abilities and disabilities in any field will all be found to be distributed in the total population roughly in the percentages represented by the form of the normal distribution curve.

Individual differences in traits and capacities seem to be due both to hereditary predispositions and to environmental conditions. Such physical characteristics as eye and hair color are largely, if not wholly, the result of

hereditary factors, while some physical characteristics such, for example, as weight seem to be greatly influenced by environmental conditions. It is difficult to determine the extent to which hereditary and environmental factors have played a part in the case of most traits and capacities. Each trait and each capacity seem to be made of a combination of elements, any one of which may be influenced in varying degrees by varying factors. The question of the relative roles of "nature" and "nurture" is one which is still far from solution. Whatever the causes underlying individual differences, this tendency of traits to distribute themselves in different degrees is one of the tendencies which has to be taken account of in any system of education. It is a well-established fact that the same degree of training in any function or capacity given to two individuals initially different does not make those individuals more nearly approximate each other in that function or capacity at the end of the training period. On the contrary, the original disparity appears to be increased. If one takes a group of children in the preschool period and puts them under the same conditions, one would expect to find (*a*) that they were initially different in regard to capacities of all sorts, (*b*) that their environment produced changes in them more or less dependent upon their innate capacities, and (*c*) that at the end of a training period, unless great effort had been made to produce uniformity by giving more work to the less endowed and less to the superior than to the average, their individual differences would not have been decreased by training, but would rather have been increased.

Individual Differences in Rate of Growth. Baldwin and Wood have given us excellent standards of growth for children

during the preschool period. They have also pointed out the fact that it is the individual-growth curve which is important inasmuch as the tendency to grow at definite rates appears to be an innate capacity. It is probable that the rate of growth may be modified to some degree by such environmental conditions as good food or the reverse, the proper amount of rest, relaxation, and fresh air. The group of children in the Merrill-Palmer School* actually did show an increase in height and weight greater than was to be expected on the basis of such increase in children outside the school, but it appeared to be true here, as it was in Baldwin's researches, that there were still wide differences in the rate of growth of individual children within the group.

Probably the best measure of weight for age is the one which appears to be in common use at the present time, *viz.*, one which takes into account the height of a child and the group from which he comes. A child may be well under height as compared with the standard height for American children of his age and yet to be up to average for the height of children of his own race. Similarly a child may appear to be below height as compared with the average for his group and yet be normal for the family from which he comes. Baldwin suggests that an individual profile plotted in terms of increments of growth for each child is a wise method. If the percentages of gain in height or weight appear to be lower than they should be for that child at that age and that particular time of the year, a physician should be consulted or some steps taken to

* RAND, WINIFRED, MARY E. SWEENY, and E. LEE VINCENT, "The Growth and Development of the Young Child," W. B. Saunders Company, Philadelphia, 1934.

determine what is producing the diminution in rate of growth or in the acquisition of weight.

There seems to be a wide difference in the rate at which children develop in anatomical age. By this term is meant

FIG. 15.—Roentgenogram showing the development of the bones of the wrist, lower forearm, and hand of Case *A*, a girl aged three years six months. (*Courtesy of Drs. A. Graeme Mitchell and Frank Stevenson, Department of Pediatrics, College of Medicine, University, of Cincinnati.*)

such changes as the ossification of the long bones, particularly the bones in the wrist, the eruption of the teeth, and those changes in physiological function which Crampton has termed "physiological age." There seems to be a wide sex difference in regard to the rate at which the bones ossify. Woodrow (23) states, in summarizing Pryor's investigation:

In round figures he (Pryor) finds the following differences: From the age of one to the age of two, the difference in anatomical age is about one-half year. Anatomically, the girl of one and a half years is as old as the boy of two. This difference gradually increases. At the age of four the girl is anatomically as old as the boy of five. By the age of seven and

FIG. 16.—Roentgenogram showing the development of the wrist bones and the bones of the hand and forearm in Case *B*, a boy aged six years eleven months. (*Courtesy of Drs. A. Graeme Mitchell* and *Frank Stevenson, Department of Pediatrics, College of Medicine, University of Cincinnati.*)

a half the girl is as old anatomically as the boy of nine, and by the age of ten and a quarter she is as old as the boy of twelve and three-quarters. This latter difference agrees with that displayed at puberty, with respect to which we may say that the girl of twelve and a half is as old as the boy of fifteen.

Woodrow also states that "sex differences, like individual differences, increase with age." In the preschool period the

difference between the sexes is relatively slight in terms of months. It is often possible to determine peculiarities in glandular function by the anatomical age of the child, but until there has been much further work on this phase of

FIG. 17.—Roentgenogram of lower forearm, wrist, and hand of Case *C*, a girl aged eleven years ten months. (*Courtesy of Drs. A. Graeme Mitchell and Frank Stevenson, Department of Pediatrics, College of Medicine, University of Cincinnati.*)

development, it would not be wise to draw too many conclusions from variation from the average in any particular case. Some authorities state that Roentgenograms of the wrist bones alone are sufficient to give an indication of anatomical age. It would probably be a wise process to

have such Roentgenograms made of each child at stated periods throughout the year and to have these filed with the other records of physical growth. It will only be by the amassing of such records taken in connection with records of physical growth and the maturing of other functions that the real significance of anatomical age will come to be interpreted (14).

Individual Differences in Intelligence. If one makes a test of the intelligence of a group of school children or of a group of children of the same age in the general population, one will find that here again the grades of ability are distributed in the form of the normal distribution curve. According to Terman's figures (16) concerning the distribution of the intelligence quotients of 905 unselected children from 5 to 14 years of age, 0.33 per cent fall between 56 and 65; 2.3 per cent fall between 66 and 75; 8.6 per cent between 76 and 85; 20.1 per cent between 86 and 95; 33.9 per cent between 96 and 105; 23.1 per cent between 106 and 115; 9.0 per cent between 116 and 125; 2.3 per cent between 126 and 135; and 0.55 per cent between 136 and 145. These differences in intelligence level appear to be largely the result of differences in native capacity.* The significance of the different intelligence quotients as presented by Terman's figures is, briefly, this: The intelligence quotient indicates that relation which the child's mental age bears to his chronological age. It indicates the number of months which he has advanced mentally during one year, or some similar period's advance in chronological age. For example, a child whose I.Q. is 75 would have progressed mentally approximately three-quarters of a year for every year's advance in chronological age. At the age of four years chronologically,

* For earlier discussion on this point, see Chapter Two.

he would have reached a mental age of three; at the age of eight, a mental age of six; at the age of twelve, a mental age of nine; and at the age of sixteen, a mental age of twelve. The question immediately arises as to whether these distribution curves in intelligence could be changed by the application of correct methods of education and training in the preschool period. For example, would it be possible by intensive training to raise the mental level of a child who would originally have made an I.Q. of 100? The rating of 100 is taken to be the average, inasmuch as 100 indicates that a child has progressed one year mentally for every year of increase in chronological age.

One answer to this question can be made. If by intensive work in the preschool period it is possible to raise to 100 an I.Q. originally 75, by the same amount of intensive work it should be possible to raise one which would originally have been 100 to a corresponding degree. If this were the case, such intensive training in the preschool period would not do away with differences in intelligence, though it is possible that it might raise the level of intelligence as a whole. Even if the lowest limit of intelligence were raised by such intensive work, and instead of I.Q.'s of 50 or below, we now had I.Q.'s beginning with 100 and running up from there, the child with an intelligence quotient of 100 would hardly be in a better condition to compete with the child whose intelligence quotient would originally have been 100 but who had had his intelligence quotient raised to a corresponding degree by intensive training, than he would have been had his intelligence quotient remained 50 while that of the average child remained at 100. It is, of course, a logical absurdity to assume that the intensive training that will raise 50 to

100 will not also raise 100 to a corresponding degree. One is still left with the problem of individual differences in intelligence just as, though one feeds a group of children the best foods in optimum amounts, one is still left with the problem of differences in size and weight.

In dealing with differences in intelligence in the preschool period, the problem would seem to be largely one of adapting the material to the innate capacity of the individual, so that every individual within the group would receive the maximum benefits from the material presented. This would provide equality of opportunity, but it would never ensure equality of capacity.

Terman's study of 1,000 intelligence quotients* gives the following results:

The child reaching		110	is equaled or excelled by	20	out of 100
" " "	(about)	115	" " " " "	10	" " "
" " "	"	125	" " " " "	3	" " "
" " "	"	130	" " " " "	1	" " "
The child testing at	(about)	90	is equaled or excelled by	80	out of 100
" " " "	"	85	" " " " "	90	" " "
" " " "	"	75	" " " " "	97	" " "
" " " "	"	70	" " " " "	99	" " "

According to Terman,† the significance of these various intelligence quotients is as follows:

* Terman, Lewis M., "The Measurement of Intelligence," p. 78.

† Terman, Lewis M., "The Measurement of Intelligence," p. 79.

Gates, "Psychology for Students of Education," p. 435, gives the following table of the distribution of intelligence:

I.Q. below 70	1%	I.Q. 100–109	30%
I.Q. 70–79	5%	I.Q. 110–119	14%
I.Q. 80–89	14%	I.Q. 120–129	5%
I.Q. 90–99	30%	I.Q. over 130	1%

Above 140	"Near" genius or genius.
120-140	Very superior intelligence.
110-120	Superior intelligence.
90-110	Normal, or average, intelligence.
80- 90	Dullness, rarely classifiable as feeble-mindedness.
70- 80	Border-line deficiency, sometimes classifiable as dullness, often as feeble-mindedness.
Below 70	Definite feeble-mindedness.

The author would question this classification in regard to both the upper and lower limits, inasmuch as some adult cases with intelligence quotients of 70 can hardly be classified as feeble-minded, and it is doubtful if an intelligence quotient of 140 alone can be said to indicate genius or "near" genius (6 to 10).

Many other factors, including emotional stability, line of interests, opportunities provided by the environment, rate of work, and degree of fatigability appear to enter in as determiners for the actual amount of productivity that can be expected of any one individual. The degree of fatigability apparently differs widely from individual to individual, as does the rate of work.

To illustrate our point, let us take the cases of A and B, both of whom might be supposed to have intelligence quotients of 140. A can work but one hour before he becomes so fatigued that he begins to make errors. B can work three hours before this period of fatigue sets in. On the mere basis of fatigue alone, A would have to interpolate a number of rest periods or seek a change of work at the end of an hour, whereas B could continue in his occupation for two hours longer. If one adds to this factor of fatigue that of rate of work, one has a further chance that B may surpass A. If, for example, B reads more rapidly, so that B can complete six pages while A is completing two, at the end of the first hour B has already covered three times as

much material as has A. At the end of a week the difference in the actual amount of work done would be appreciable. At the end of several years the difference in the amount of work accomplished by the two individuals of equal capacity insofar as intelligence level alone was considered would be enormous. The low limen of fatigue in the case of A might be due to factors either innate or acquired, such as general health, susceptibility to eyestrain, and so forth.

The possession of a high intelligence does not necessarily imply genius, in spite of the classification in use by Terman (15) and others. Genius is probably the result of specific genes and is an heritable character, exactly as are eye color and nose shape. The fact that geniuses have a large number of geniuses in their ancestry, as compared with the expectation of geniuses in the ancestry of the ordinary individual, indicates this clearly. Galton (6) found that 977 eminent men possessed a total of 535 eminent relatives, while 977 ordinary men had only 4.

Terman, Hollingworth, and others have proved that the possession of high intelligence does not even indicate success in ordinary adjustments in the business world, much less does it indicate genius. Such studies as those of Scheinfeld* on musical talent indicate clearly the part played by heredity. It is true that a high intelligence usually indicates greater proficiency than average in most activities. The selection of a field in which the individual seeks eminence is usually the result of social pressure. A man with the genes predisposing toward genius might show it in any one of several fields, but because of the rewards which society gives at the time in which he lives, he may select one rather than any other.

* *Ibid.*

It is highly unreasonable to suppose that there was anything in the genes which predisposed toward success in the literary field in Elizabethan times, and only in those times, while eminence was sought in the 1890's and early 1900's in the field of business. This selection is purely societal. The inventive geniuses of today might well have been the writers of the Elizabethan period. Today's scientists might equally well have sought success in the business world in an earlier era. That eminent scientists can and do succeed excellently in business has been demonstrated more than once.

One scientist whose salary had never reached $10,000 as a college professor, was able to earn more than the President of the United States as a business executive, when circumstances forced his entrance into a field other than science. There are numerous instances of eminent medical men who could have been equally eminent in literature, art, or both. Michelangelo could have excelled in mathematics and in other fields had the rewards been offered them instead of to art. In a word, it would appear that there is an x factor which predisposes toward eminence and even genius, but this is not a single unit character.

Intelligence alone, as we have stated previously, is not a guaranty of genius or even of success in ordinary life adjustments. The writer has studied the case histories of 110 children whose intelligence quotients were 145 or better. This study has been carried on from 1917. Though all of the children studied have reached the age of thirty or more, not one case has attained eminence or shows any promise of attaining eminence. All have made successful life adjustments. Other studies have, as we have pointed out, demonstrated the same point.

Individual Differences in Emotional Stability. If one were to rate a group of adults on the degree to which they appeared to work at a low level emotionally, at average, at above average, or at a high degree of emotional tension, or under such emotional stress that a slight stimulus would produce a great degree of disturbance, one would find again that in these capacities they fall into groups the sizes of which are roughly as indicated by the percentages for the normal frequency curve. One would find individuals who appeared to be undisturbed when the average individual would show signs of strong emotion. One would find individuals whose emotional control was far above the average. One would find individuals who were disturbed at times but who generally worked under slight emotional tension, others still who appeared to be relatively easily disturbed, and still others in whom the slightest experience appeared to set up great emotional disturbance. These individual differences might be due to some inherited neural pattern, to physical conditions the bases for which were either innate or acquired or both, to peculiar conditioning during infancy, or to other causes. In a group of children one finds much the same distribution in degrees of emotionality. Other things being equal, the degree of education which will be necessary to make those at the extreme limit of emotionality approximate the average will probably be great, whereas those originally endowed with a high degree of stability will probably need relatively little training in emotional control.

Individual Differences in the Strength of Instinctive Tendencies. Though all children possess the instinctive tendencies to some degree, these vary widely in strength from individual to individual.

Self-assertion. If one takes, for example, the instinctive tendency to self-assertion, one finds that some children appear to react to thwartings of any kind with great violence and that an attempt to control by thwarting fails completely in its effect. Punishment for such children seems merely to increase the degree of stubbornness with which they resist authority. The more opposition children of this type have, the more they appear to develop stubbornness probably on the basis of the law of use. One may even increase the severity of the punishment within such limits as one dares without having the punishment accomplish its purpose. Such children can be brought to cooperate with persons in authority, but they cannot be forced to carry out commands.

Instances of parents who have attempted to force such children to eat desirable foods are not infrequent. In these cases all that has been developed is a stubborn resistance to any attempt to get the child to eat the correct amount of proper foods. Regurgitation, temper tantrums at the table, and actual refusal to eat are frequently results of trying to force children to eat what they could be brought to eat with different methods. Many feeding problems arise in connection with this type of resistance.

On the other hand, some children react to thwarting with a slight protest which under continued attempts to enforce authority appears to drop away. In the first case the type of behavior which is produced by too great exercise of authority appears to be contrariness, temper tantrums, or such behavior as that cited in the discussion in Chapter Eleven. In the second type of case, the behavior produced appears to be a tendency to oversuggestibility, to taking the line of least resistance, or to giving in when-

ever faced with superior force. The writer has noticed such behavior as this in a child with an intelligence quotient of 140. This child, age three and a half years, had a brother of very aggressive disposition. The second child's aggressiveness had been encouraged by the fact that his parents insisted that he should have what he wished because he was "younger." The first child, though one and a half years older than the second, would give up to him any toys which he wished and would carry out any commands which he saw fit to give. This general attitude of lack of resistance in the older child was noticeable in regard to enforcement of authority on the part of adults. She would whimper a little when the demand seemed wholly unreasonable, but in the main she carried out without protest whatever was suggested. At the same time she appeared to lack initiative and the willingness and the desire to overcome obstacles. It has been noted by Woolley (22) that in some cases aggressiveness is so outstanding a part of a child's behavior that long-continued treatment will hardly cause it to diminish. In some instances a child may have brought to bear upon his too great tendency to aggressiveness the force of the disapproval of a whole group of children and of adults. He will find that the children will not play with him because he is too "bossy" and that when he enters the group and begins to try to command, they refuse to follow his leadership. While such children will probably become leaders if the instinctive tendency which shows itself in such great aggressiveness can be curbed to some extent, unless a long period of training is given to them the power to exercise the leadership is lost. They remain so aggressive that the group will not work with them, and one finds them as adults unable to exercise the ability which they possess because they

cannot secure cooperation from individuals or groups. The preschool period is preeminently the time for curbing overaggressiveness, but it must be realized that this is no small task in the case of some children.

The tendency to become uncomfortable at the sight of suffering appears to differ from individual to individual much as does the tendency to self-assertion. The author has in mind one child who would become violently disturbed at crying, at any injury to a pet or doll, or at any injury or supposed injury to a member of the family. It was necessary for her to take a long period of reconditioning in which, every time the child appeared to be upset at the sight of injury to some object or person, she was given an outlet in the form of something to do immediately upon her perception of the injury. In this way an attempt was made to give some outlet to the tendency other than that which was given when the child merely became emotionally upset. Some children, on the other hand, appear to have so little perception of what constitutes suffering in others as to be abnormal. A case of this type, a boy aged nine, would take actual pleasure in tormenting and injuring young children and animals. This boy had to be institutionalized because of his abnormal tendency.

Children perceive suffering as it occurs in others roughly in proportion as they are mature enough to recognize the signs of distress or pain. Much of what appears to be hardheartedness is merely a lack of perception due to immaturity.

Gregariousness. The tendency to get together in groups has been treated in an earlier chapter of this book. Inasmuch as this tendency appears to develop somewhat late, it is impossible to differentiate between what was the

inherent strength of the tendency and what has come about as a process of direct conditioning. Whatever may be the cause, children appear to differ greatly in regard to their dependence upon association with groups. The desire to keep away from other children after the age of eight or nine, or even somewhat before this, can be taken as an indication that there is something wrong with the social adjustments of the child who feels in this manner. Steps should be taken to determine the cause of his behavior. With all children, as with all adults, there are periods during which the individual does not wish to be a part of a group, so that a certain amount of desire for solitude for work, or for any other activity, is to be expected. As has been pointed out, group play and the dependence upon other children for the carrying out of play activities are not characteristic of the preschool period. A certain amount of individual difference can be expected as to the extent to which the child desires to have company or to mingle with large rather than small groups.

Sufficient attention has probably been called to the difference in the strength of the instinctive tendencies, for what has been said in regard to individual differences in gregariousness, the tendency to self-assertion, and the tendency to become uncomfortable at the sight of suffering in others applies as well to the other instinctive tendencies. The degree to which the variation among individuals is due to innate predisposition or to environmental condition is yet to be determined. The author does not take the position that individual differences in any of the traits or capacities cited, except intelligence, are solely due to innate predisposition. Insofar as intelligence is concerned, such evidence as we have points to the fact that individual

differences in intelligence are innate except in cases where they have been produced by disease or by prenatal conditions. So far, all attempts to change intelligence level in children of school age by bettering the environmental conditions have not met with success.

TABLE VII.—CORRELATIONS OF INTELLIGENCE QUOTIENTS AND VARIOUS TRAITS IN A GROUP OF 150 FIRST-GRADE CHILDREN

Trait	Correlation with I.Q.
Sense of humor	.58
Persistence	.53
Initiative	.53
Will power	.50
Conscientiousness	.48
Personal appearance	.44
Cheerfulness	.43
Physical self-control	.42
Courage	.39
Dependability	.38
Emotional self-control	.29
Unselfishness	.29
Speed	.28

Within the limits of the range of intelligence from high-grade feeble-mindedness to the superior levels, the adjustment appears to depend largely upon the character of the individual and the extent to which the material which has been presented to him has been adapted to his needs. A high level of intelligence does not ensure the possession of desirable character traits or of physical vigor, or, in fact, of any other quality. Neither, as has been indicated by Gates,* does the assumption of the presence of one desirable trait imply the possession of compensation in the form of other traits which are undesirable. The following list, based on the work of Dickson, is taken from Terman (15). It indicates clearly that there is some tendency for

* GATES, A. I., Psychology for Students of Education, p. 479.

desirable traits to be correlated with intelligence, but it indicates equally clearly that a high level of intelligence does not necessarily imply the possession of any one of the desirable character traits to an equal degree.

The problems of training during the preschool period would involve taking account of individual differences in physical make-up, in mental level, in the strength of instinctive tendencies, and in tendencies to develop particular personality traits, and adapting the material which is to educate the child during the preschool period to the end that he reaches or approximates the limit of his capacity in all desirable traits and functions. His health should be brought to as high a degree of efficiency as possible, his intelligence should be made to function as nearly as possible to capacity, and he should have called out and strengthened those tendencies to personality traits which result in his best adjustment both in the family and in society as a whole.

EXERCISE

Note the behavior of your subject when with a group of children.

What is his attitude toward other children? Note, particularly, evidences of courtesy, leadership, initiative, overaggressiveness, and oversuggestibility.

What type of response does he show to authority?

Does he seem overresistant to suggestions from other children?

Does he seek companionship? Does he appear to avoid it?

How far does he appear to stand up for his own rights? For those of other children?

How far does he appear to be influenced by the behavior of other children? Has he developed a sense of property rights? Of fair play?

To what extent will he cooperate with the group? Does he seek attention unduly? Is he shy?

Compare the behavior of your subject with that of other children of the same age and draw conclusions as to the degree of maturity which he has reached in his social adjustments.

Bibliography

1. Bentley, John Edward: "Superior Children," W. W. Norton & Co., New York, 1937.
2. Carroll, Herbert A.: "Genius in the Making," McGraw-Hill Book Company, Inc., New York, 1940.
3. Cox, Catharine M., *et al.:* Early Mental Traits of Three Hundred Geniuses, in "Genetic Studies of Genius," Vol. II, Stanford University Press, Stanford University, Calif., 1926.
4. Ellis, Havelock: "A Study of British Genius," Hurst and Blackett, London, 1904.
5. Gates, A. I.: "Psychology for Students of Education," Chap. XIX, The Macmillan Company, New York, 1923.
6. Galton, Francis: "Inquiries into the Human Faculty and Its Development," Everyman's Library, 1883; E. P. Dutton & Company, Inc., New York, 1919.
7. Hildreth, Gertrude: "Characteristics of Young Gifted Children," *Pedagogical Seminary and Journal of Genetic Psychology,* Vol. 53, December, 1938.
8. Hollingworth, Leta S.: "Gifted Children: Their Nature and Nurture," The Macmillan Company, New York, 1926.
9. Hollingworth, Leta S.: "What We Know about the Early Selection and Training of Leaders," *Teachers College Record,* Vol. 40, No. 7, April, 1939.
10. Hollingworth, Leta S., and Ruth M. Kaunitz: "Centile Status of Gifted Children at Maturity," *Pedagogical Seminary and Journal of Genetic Psychology,* Vol. 44, 1935.
11. Myers, Garry C.: "The Exceptional Child as a Behavior Problem in the Home," *Baltimore Bulletin of Education,* Vol. 13, March, 1935.
12. Norsworthy and Whitley: "Psychology of Childhood," Chap. XVI.
13. Pintner, Rudolph: "Intelligence Testing," Henry Holt and Company, Inc., New York, 1923.
14. Prescott, D. A.: "The Determination of Anatomical Age in School Children and Its Relation to Mental Development," *Harvard Monographs in Education,* 4, 1923.
15. Terman, L. M.: "The Intelligence of School Children," Houghton Mifflin Company, Boston, 1919.

16. TERMAN, L. M.: "The Measurement of Intelligence," Houghton Mifflin Company, Boston, 1916.

17. TERMAN, LEWIS M., and MELITA, ODEN: "Status of the California Group at the End of Sixteen Years," *Thirty-ninth Yearbook of the National Society for the Study of Education*, Part I, Public School Publishing Company, Bloomington, Ill., 1940.

18. TERMAN, LEWIS M., *et al.*: "Mental and Physical Traits of 1000 Gifted Children, Genetic Studies of Genius," Vol. I, Stanford University Press, Stanford University, Calif., 1925.

19. TODD, T. WINGATE: "Atlas of Skeletal Maturation," the C. V. Mosby Company, Medical Publishers, St. Louis, 1937.

20. WITTY, PAUL A., and HARVEY C. LEHMAN: "Nervous Instability and Genius: Some Conflicting Opinions," *Journal of Abnormal and Social Psychology*, Vol. 24, January–March, 1930.

21. WOODROW, HERBERT: "Brightness and Dullness in Children," J. B. Lippincott Company, Philadelphia, 1923.

22. WOOLLEY, HELEN T.: "Agnes, A Dominant Personality in the Making," *Pedagogical Seminary and Journal of Genetic Psychology*, December, 1925, pp. 569–598.

23. ZORBAUGH, HARVEY W., editor: "Gifted and Talented Children," *Journal of Educational Sociology*, Vol. 10, October, 1936.

SPECIAL PROBLEMS IN CHILD DEVELOPMENT

Eating Habits. Training the child to eat wholesome foods at regular hours, like any other habit, involves the operation of certain fundamental principles of habit formation: (*a*) practice should occur under conditions as uniform as it is possible to secure; (*b*) satisfaction should follow successful adjustment and should never become associated with undesirable activities; (*c*) unpleasant results should never be associated with activities which it is desirable to make habitual.

The first of these principles—practice under uniform conditions—involves: (*a*) regular hours for meals with strict adherence to these; (*b*) the same place for eating; (*c*) as nearly as possible, the same table utensils and furnishings; (*d*) as nearly as possible, the same types of foods for the particular meal. To repeat a breakfast menu for dinner and have the dinner menu for supper is often exceedingly upsetting. Children like to know what to count on in all situations. Indeed the adult would find himself disturbed if a dinner menu were substituted for breakfast or the reverse, yet it is not unusual to find such substitutions of menus in the early stages of setting up correct habits in children.

To give a child his noon meal sometimes at twelve, sometimes at half after eleven, and sometimes at half after twelve breaks the first of the principles listed. There appears to be a certain physiological rhythm for hunger and one cannot, therefore, expect it to appear at ordered intervals—at times at eleven-thirty and at other times at twelve-thirty.

Changing the room in which the children eat often upsets habits in the process of being set up or retards the setting up of food habits. Children fed sometimes in the living room, sometimes in the kitchen, sometimes in the dining room—in a word, fed just anywhere—are frequently too conscious of their changing environment to attend to food. Changing in table furnishings and the actual table at which the child eats produces like results. The physiological responses which are associated with hunger and which carry on digestion are in the nature of conditioned reflexes. The constant changing of stimulation which is inevitable when children are fed first under one set of conditions, then under another, may be sufficient to retard conditioning materially.

The perception of a particular kind of food in a particular dish soon comes to be associated in early childhood with the production of those secretions necessary in digestion. Just as the adult associates salivary secretion with the odor of coffee or of a well-cooked luncheon or even with the picture of chocolate cake or some similar dainty as seen in a magazine advertisement, so the child conditions reflexes involved in secretion of saliva and the digestive juices in the stomach. The utensils and plates on the table, the color and texture of the food, the odor, and the like, are visual and olfactory perceptions which

start these secretions originally started only by the presence of food in the mouth. It is well to keep the same order in the presentation of foods since to this, too, children are early conditioned.

In infancy, the child is fed equal amounts at four-hour intervals either from the breast or from prepared foods. The transition to three meals a day involves two changes—a slight difference in the hour at which the meal is given, and a longer interval between feedings.* In order to reduce the time interval between feedings, a mid-morning lunch of fruit juices should be served. Except in the case of undernourished children where the doctor advises the introduction of other foods, no between-meal feeding other than fruit juices should be given. In-between feeding in most cases serves to dull the appetite at the regular meal hour.

Factors Influencing Appetite. Satisfaction in the case of the actual food itself arises in connection with the satisfaction of appetite and in connection with the attitude of the parents toward eating. Appetite is conditioned by the attitude of the parents, *i.e.*, by the fact that they expect the child to have a good appetite or the reverse by the fact that they think it is interesting if the appetite is slight or give him a great deal of attention because of slight appetite, and the like.

Appetite is also affected by the physical condition of the child. The presence of any focal infection is apt to affect appetite markedly. A three-year-old in the nursery group ate so little that she was 20 per cent underweight until the

* The change from a liquid diet to a solid one will be discussed in a later section.

removal of bad tonsils. As soon as the effect of the operation had worn off, the child began to eat normal quantities of a wide variety of foods and has not until this day shown any further feeding problems.

Any housing defect which reacts upon the physical condition of the child is apt to lower interest in foods. Outdoor play also appears to be an essential for appetite. A four-year-old who had been brought up in the country until the end of his third year was found to have no interest in food after he had been in the city four months. Investigation of the home conditions disclosed the fact that the child played fairly actively in a three-room apartment but had not more than a half hour of outdoor exercise during any one day. Increase of this exercise period to 2½ hours produced a good effect almost immediately. At the end of six months, during which this child had had an average amount of three hours per day of outdoor exercise, no feeding problem remained. Neither of these problems would have disappeared had a great deal of comment and excitement gone on during the period of poor appetite.

Fatigue resulting from overstimulation, from over-exercise, or from some other cause is frequently productive of nonhunger. In the case of many active children, a rest of twenty minutes before meals or even a rest of half that time, if the child is quiet during the rest period, will result in heightened appetite.

Children who exercise violently just before the meal hour, and are then rushed in, washed rapidly, and rushed to the table are often too fatigued to show any interest in foods. Violent games just before the meal hour are equally effective in reducing appetite.

In the case of some hyperactive children, the rest alone is not sufficient to reduce fatigue. With these, quiet games should alternate with periods of activity. Such plays as go on in the sandbox or with blocks or in the dollhouse are excellent to break the strain of a long morning of riding the kiddy-car, running, and the like.

Too little sleep may also produce nonhunger or resistance to food. A three-year-old who was a feeding problem was found to have not more than nine hours sleep per day including a rest hour and a half-hour nap immediately after noon dinner.

Feeding between meals and thus reducing the interval allowed for digestion often means that the food has not left the child's stomach. Hunger can hardly be present while the food is still undigested. As stated in the earlier part of this chapter, three meals a day with fruit juices between is adequate for the average child. This should be increased only upon the advice of the child's own physician. Children not infrequently eat three to four times a day in between meals. This is particularly true in the case of the undernourished child whose family appear to be anxious to compensate for his lack of appetite at meals by feeding him as frequently as possible during the day. In many cases, the family are not at fault. The food is introduced to the child's diet by neighbors under the impression that it will be of advantage to him.

Nonhunger may be produced by peculiarities in the diet. It occasionally happens that the person who has charge of feeding the child is so anxious to introduce calories that these are introduced in bulky forms and with too great similarity in the components of the meal. The following menu taken from a study of a case of nonhunger will serve

to illustrate this point: a large baked potato, chopped meat (dry), peas (dry), lettuce sandwich, tapioca pudding without sauce. The number of calories in a meal of this sort is obviously adequate but there is a correct balance neither in the elements of which these foods are composed nor in the textures. Furthermore, a meal in which most of the material is dry and bulky involves much more effort to eat than a meal of varying textures. The large baked potato alone would be sufficient to daunt a child whose appetite was not unusually keen.

Another field in which problems may lie is the introduction of new foods. The flavors of these should be introduced in the diet early. Many nutrition specialists advise feeding vegetable juices as early as the pediatrician in charge of the case feels this to be wise. Where this is done, the child is accustomed to a variety of flavors long before solid foods are given, and much of the resistance which accompanies the introduction of new foods is done away with because the child recognizes similarity in flavor even though the textures are dissimilar to those to which he has been accustomed.

Habits Involved in Eating. The change from a liquid to a solid diet involves many new habits as well as the conditioning of positive reactions toward a new type of cutaneous and kinesthetic sensations. To both of these sets of reactions satisfaction must be attached, since the transition is difficult to make. Liquid food has simply been swallowed and no further motor reactions than the swallowing are required. In the case of solid foods, a number of reactions must be made. Chewing, which requires much effort in many children, rolling the food around in the mouth, and swallowing with much greater effort are only a few of the habits required. In addition to these, there is the even more difficult

series of motor adjustments required if the child is to carry food from the plate to his mouth. Problems may arise both in the acquisition of new tastes and conditioning toward solids and in the acquisition of the motor habits required to carry the food from the plate to the mouth.

Blatz (6) has given the following six objective aspects of eating processes which may be noted even by untrained observers:

1. *Application.* Does the child require any urging in order that he may finish all the food that is placed before him as a first helping?

2. *Motor Inhibition.* Does the child stay in his place throughout the whole meal, or does he get up from his chair, assume an awkward posture, tilt his chair, fall off, etc.?

3. *Choice of Tools.* Does the child use the proper utensils? By proper is meant a fork for solid food, and a spoon for liquid food. Does he use his fingers?

4. *Technique of Eating.* Does he take moderate-sized portions on his fork or spoon and does he bolt his food or nibble at it?

5. *Motor Coordination.* Has he spilled food upon his table napkin (always tucked under his chin) or is it clean at the end of the meal?

6. *Tidiness.* Does he leave his place at the table and the floor about his chair tidy after the meal, as regards food spilled, discarded, or secreted?

The number of items listed will serve to show the variety of activities involved in the apparently simple habit of sitting at the table and eating. In order to acquire these habits, much practice is necessary. This practice should always be coupled with satisfactory results.

In his first attack on the food, the child fails to carry all the food to his mouth. He may not even reach the mouth

with certain spoonfuls but spill them on his clothes and on the table. The satisfactory result comes from the food which actually reaches his mouth. Scolding for spilled food will inevitably attach unpleasant results to the activities involved in eating and frequently will result in retarding the setting up of correct habits in the use of tools, as well as in destroying appetite.

As has been made clear in the chapter on emotions, anger and fear cause a cessation of all the secretions involved in digestion. The mouth becomes dry, and the stomach secrets a mildly toxic substance instead of the digestive juices. There is a cessation of the churning movement of the stomach and of the peristaltic movements of the intestines. Unpleasant scenes in connection with foods or the table situation arouse anger or fear states. In time, the reactions involved in these emotions become attached to the foods and to the table situation and these alone may produce all the reactions originally associated with scolding or quarreling at the table. We have again an instance of conditioned reactions. It has been made clear that it is extremely easy to attach both fear and anger states to situations with which they were not originally associated. It is particularly easy to make this transfer in connection with food, sleep, and toilet habits.

Children may need to be helped toward the end of the feeding period inasmuch as the time and effort involved in carrying the food from the plate to the mouth is enormous. The effort is sometimes so great as to constitute an unpleasant result in itself. Children should be helped only to such an extent that severe fatigue does not set in, and help should be reduced in proportion as they acquire control over movement.

Psychological Causes of Feeding Problems. On the side of the psychological causes* of resistance to food, we have

* A series of experiments conducted by Dr. Clara Davis (18) of Chicago throws some light on the ability of children to choose their own diet. Her subjects, ten in all, have been allowed to choose their own food since the day of weaning. The foods presented before the children included meats (beef, lamb, chicken), glandular organs (liver, kidney, brains, sweetbreads), sea food (haddock), cereals (whole wheat, oatmeal, barley, corn meal, rye), bone marrow and bone jelly, eggs, milk including whole lactic milk, apples, oranges, bananas, tomatoes, peaches or pineapple, lettuce, cabbage, spinach, cauliflower, peas, beets, carrots, turnips, and potatoes. These foods were placed on the table in front of the children on a tray. Not all the foods on the above list were presented at each meal, but foods from each of the classes listed were presented.

The children chose their food either by indicating the dish, or, when sufficient motor coordination had developed, by picking up a handful of it. When an infant finished one dish of a particular food, an additional dish of the same food was placed in front of him. The dishes were changed in their position on the tray so that no place suggestion might be operative.

It is interesting to note that all her subjects were able to keep in good condition on the foods taken by them, though at a single meal a child might eat lactic milk and potatoes with a very limited amount from any of the other dishes.

Dr. Davis states that "a tendency was observed in all the infants to eat certain foods in waves, *i.e.*, after eating cereals, eggs, meats or fruits, in small or moderate amounts for a number of days, there would follow a period of a week or longer in which a particular food or class of foods was eaten in larger and larger quantities until astonishingly large amounts were taken; after this, the quantities would decline to the previous level."

On the day on which the writer observed these children, one child ate three saucers of peas and almost no other food. Dr. Davis states in commenting on the ability of her subjects to select food suited to them that "Donald R., the pH of whose gastric contents was the highest (commonly about 2.5) throughout the six months, chose a diet with a large excess of alkaline foods; Abraham G., the pH of whose gastric contents was commonly close to 3.0, a diet in which alkaline and acid foods were almost exactly balanced; and Earl H., with a pH of the gastric contents generally about 2.7, a diet in which the excess of alkaline foods was practically midway between the two."

It is interesting to note that these children would preserve themselves in

first, the possibility that the child is being rewarded for exhibitions of nonhunger. He may be the source of continual conversation as to his food likes and dislikes and as to the difficulties which are encountered in making him eat. As has been pointed out previously, to be the center of attention and the cause of excitement is one of the great rewards in early childhood. The satisfaction which results from this may be sufficient to outweigh any unpleasantness which comes from hunger pangs. In a short while, these may be disregarded and actual malnutrition develop because of refusal to eat an adequate food supply.

The reward may come in terms of actual food treats as, for example, the feeding-problem child whose parents gave her a tea party consisting of cakes and jam sandwiches the afternoons of the days on which she had refused to eat dinner. A second child who was a feeding problem received a large supply of chocolate cake with icing and a glass of milk the afternoons on which she had not eaten a sufficiently large meal. A third child was asked in the morning whether she felt hungry or not, and on the days on which she stated that she was not hungry, she was allowed to choose the

---

excellent health and that an occasional child actually ate himself to a healthy condition, supplying by his choice of foods the needed constituents.

From this experiment, it should not be judged that all children should be allowed to choose their own diets. In the first place, sweets and pastries were not included nor were any sorts of made desserts. In the second place, no seasoning had been introduced in foods, and, in the third place, there had been no conditioning of the children by the remarks of the family.

This experiment is interesting in that it indicates that children need not have a completely balanced diet for each meal but may on the contrary be allowed a certain latitude without developing physical difficulties or abnormalities. The average mother at the present time is very much disturbed if the vegetable is omitted at one meal or if some other mild variation occurs. The comments which accompany this variation are all too apt to produce the very type of feeding problem which the parent is all too anxious to avoid.

dessert she liked best and to have two to three portions of this at dinner in order to be sure that she received sufficient nourishment. All of these are instances of rewarding an undesirable activity. Each of them is sufficient to produce a feeding problem without the introduction of further adverse conditions.

The child may be so overstimulated at meals that he has neither time nor energy left to attend to eating. Children who are fed at the family meal hour and who show interest in the conversation going on around them are often so absorbed in adult behavior and conversation that they do not realize that they are not eating. Here the satisfaction is attached not to foods but to the conditions surrounding the meal. Surrounding the child's tray with an array of toys, keeping up a continual flow of conversation to him and particularly about him, rushing back and forth between the kitchen and the place in which he is eating, watching every mouthful which he eats to be sure that he is getting enough, are all instances of types of overstimulation found in cases of feeding problems.

Any sort of general unpleasantness in the family relations, lack of uniformity in discipline, divided authority, and too many emotional upsets on the part of the parent or child preceding meals are all causes of nonhunger. A final cause which should be added to the list is a general negativistic attitude on the part of the child which shows itself in refusal of foods. This negativistic attitude has as its usual cause overcontrol, nagging, or some similar faulty behavior on the part of the parent. The types of problems which might occur if the child is not correctly trained are refusal of most foods, irregular eating—*i.e.,* skipping one to two meals a

day—and finickiness in appetite. In addition to these problems, dawdling may develop.

The following rules for setting up good food habits are excellent to keep in mind:

1. Be sure that the child does not get attention because of refusal of foods or finickiness in appetite.

2. New foods should be introduced early. Vegetable juices can precede the introduction of solids. When a new food is to be introduced, start with a very small quantity and serve it with other foods of which the child is particularly fond.

3. Give desserts only after a "clean plate."

4. Be sure that new foods are not introduced when the child is feeling tired or has been under unusual strain of any kind. These should be introduced only when one has reason to expect that a child's appetite is keen.

5. Vary the menu and be sure that the foods are properly cooked. Overseasoning frequently conditions children against the foods so seasoned.

6. Be sure that there is regularity in schedule and as much uniformity as it is possible to secure in the child's surroundings.

7. Avoid all unpleasantness at the meal hour.

8. Avoid giving rewards for undesirable activities and attitudes.

Habits of Sleep and Rest. The same principles of habit formation are involved in setting up sleep habits as are involved in developing good habits of eating.

Regularity in schedule is a prime essential, as is the association of pleasant results with sleeping rather than with habits of wakefulness.

The young baby probably sleeps from twenty to twenty-two hours. The major part of the infant's time is spent in sleeping and in eating. At six months, the total number of hours of sleep per day should be approximately sixteen—thirteen to fourteen hours at night and two naps of approximately 1½ hours each. The hours of sleep diminish rapidly after this time until at two, the child should sleep approximately thirteen to fourteen hours. It is in the transfer from the all-day sleeping period to sleep at regular intervals that many difficulties arise. Absolute regularity in schedule should be adhered to at this point. The hour for the morning nap, the afternoon nap, and for the beginning of the night sleep should not vary by even so much as twenty minutes.

Experimental Studies of Sleep. Chant and Blatz (2) found in their study of children's sleeping "that the child is as often as not put to bed from ten to twenty minutes before or after that time," "time" meaning the hour which the parent has given as the regular bedtime hour.

The bedtime hour in nursery-school children differed widely from family to family. The actual range from the earliest to the latest was from 5:50 to 8 p.m.

Other problems were studied in addition to the bedtime hour and regularity in going to bed. The subjects used were 13 nursery-school children ranging in age from two to five years and 102 children in their homes ranging in age from one to eleven years.

The first problem considered was to determine whether the number of children in the sleeping room at the nursery school influenced the amount of sleep per child. Though there is, on the whole, a slight decrease in the percentage of children sleeping with an increase in the number of children present in the room, this decrease is not uniformly present. A smaller percentage of children sleep when there are fourteen children in the room than when there are four. Further experimentation in which variables other than the number of children in the room have been controlled is necessary before any final conclusions can be drawn, but the study is excellent in its attack on the problem chosen.

The frequency and duration of sleeping in the group was the next problem of study. The authors came to the conclusion that fewer children sleep on Monday and that the average duration of sleep for the group is shorter on this day. There was a greater constancy in the duration than in the frequency of sleep. The authors give the days in the order of lowest frequency as being Monday, Thursday, Wednesday, Friday, Tuesday. Tuesday appears to be the highest day. There is a definite tendency for older children, *i.e.*, those above three years of age to sleep less than do younger. When the older ones sleep, the duration of their nap is about the same as that of the younger children. The sleeping habit appears to break up on the all-or-none principle. This is a point of much interest to parents since, during the fourth year, the struggle to enforce the full nap period on every day of the week is apt to begin. The records of the group under parental supervision show that day sleep decreases from approximately 1.75 hours at one year to zero at the fifth year. Night sleep also decreases. The records of the children under parental supervision do not

differ markedly from those in the nursery group. Blatz and Chant state that the Blantons' recommendations and Brown's as to number of hours of sleep appear to be too high and that Seham's are even higher. Burnham's data appear more nearly to approximate those of Blatz and Chant, according to these writers.

The fourth field of investigation was the relation of day sleep to night sleep. It was shown that the long sleep in the day is, on the whole, associated with the long sleep at night.

The next inquiry made was as to the general conditions of sleeping at home. The writers note that the earlier conventional methods of putting the child to sleep, soothing, and so on, have practically passed out. Further reference is made to wakefulness, drawing off the covers, and so on during the night. This is the only study at the present time dealing with the sleeping habit in detail.

Setting up Sleep Habits. It must be kept in mind in dealing with children of all ages that, whereas the adult often enjoys sleep because it is an escape, children find in sleep a cutting off of a series of interesting activities and contacts. What is an escape to the adult is an actual deprivation to the child. Making the process of going to bed and settling down to sleep more satisfactory than that of staying awake is, therefore, one of the serious problems in connection with habits of sleep and rest.

A regular schedule is the first essential. Next in importance to regularity of schedule come the general activities in preparation for bedtime. No noisy or exciting games and no exciting stories should precede either the nap hour or the hour for going to bed. Quiet games or stories recounting pleasant experiences are an excellent preparation.

Cameron* suggests as a preparation for going to bed for the nervous child that the child place each piece of clothing on the chair as it is taken off, pretending that it is being put to sleep. This is an excellent way of suggesting sleep to all children. A three-year-old who had previously resisted going to bed and made a scene found the activity of putting his toys to bed (if only a few were out) and putting each article to sleep so interesting that all resistance ceased.

Toys that suggest activity should be out of the range of vision in the sleeping room, as they should be in the place where the child eats. Kiddy-cars, slides, and the like suggest activity, not rest. The room should be darkened in order to cut down the amount of stimulation and to suggest restfulness. It is, of course, unnecessary to make here the point that there should be fresh air but not a breeze which blows on the child. Once the child has been put to bed, adults should refrain from going in and out of the room and from all unnecessary rattling of papers, pulling up and down of shades, and the like, since these suggest wakefulness rather than rest.

In a case of the writer's the child was visited by six people at irregular intervals between the hours of seven and nine o'clock. He had learned to expect such interruptions of sleep and to compensate for them by wakefulness until the last member of the family had appeared and left. Each member of the family gave as his reason for visiting the child the fear that he might still be awake.

Causes of Irregular and Too Little Sleep. There are a number of causes of poor sleep. Physical condition is one of the most important of these. Digestive disturbances, too

* Cameron, H. C., "The Nervous Child," Oxford Medical Publications, Chap. 5.

heavy or too light food before sleeping, diseases or difficulties of the respiratory tract, fatigue, and an unusual number of emotional upsets, are all conducive to restlessness and to the postponement of the hour at which sleep occurs. These are causes of resistance to sleep at the nap hour as well as at night.

The psychological causes of resistance to sleep are similar to the causes of nonhunger and resistance to food. A child may cut down the hours of sleep because he knows that he thus becomes the center of attention and the cause of excitement. The more that conversation surrounds the days on which sleep is short, the more frequently, in all probability, will these days occur. It must be kept in mind that all young children like to dramatize themselves, to think themselves interesting, and to cause excitement. All these ends may be gained by refusal to sleep. The negativistic attitude referred to in the section on eating may also be present here. The child who has been overcontrolled and nagged may find in resistance to sleep the one way in which he can punish the adults whose overcontrol he resents.

A four-year-old was found to have not more than eight hours of sleep per night and this restless and disturbed by apparent night terrors. A study of the family showed that this child was corrected 100 times in two hours and that it was not at all unusual for him to be spanked six times in any one day. Overcontrol and poor methods of discipline made this child both a feeding and a sleeping problem.

A discussion of the difficulties which occur at the rest hour would bring out exactly the same causes operative as in the disturbance of night sleep. The results of studies as to the absence of desire for a rest hour in children three years old and beyond should be kept clearly in mind, however, since

the experience of some other child research centers is similar to that of Blatz. Our own records show a number of children above three years of age who have at or before the third birthday refused to take any nap, though they have consented to rest a short period in the afternoon.

It must also be kept in mind that there is a wide individual variation in the number of hours' sleep required.

A consultation with the physician in charge of the child and a study of earlier sleep habits as well as observation of the nutritional condition will serve to help determine the actual number of hours required in individual instances.

There is not even a clear agreement among authorities as to the number of hours required, as Table, VIII from Blatz and Chant (2) shows clearly.

The Dry Habit. The proper age for training the infant can best be determined by a consultation with the child's physician, since attempts to train children too early are productive of problems later.

Blatz* states that in order to have the training successful, *i.e.*, to establish voluntary control, the child must be sufficiently mature to be aware of and to recognize sensations of pressure, to remember the sensations associated with the release of pressure, and to retain the necessary degree of tension in the sphincter muscles until the appropriate time and place. The entire series involves the conditioned reflex type of habit.

At first, elimination occurs solely in response to pressure. If one charts carefully the times at which this occurs, one

* Blatz, W. E., and Helen Bott, "Parents and the Pre-school Child," William Morrow & Company, Inc., p. 91.

TABLE VIII.—COMPARISON OF CHILDREN'S SLEEP BY DIFFERENT AUTHORS*

St. George's School Data						Total Recommended By:								
Age—years and months	No. of cases	No. of cases sleeping in day	Duration Day	Duration Night	Total sleep	Blanton and Blanton	Brown	Burnham	Hess	Scham and Scham	Hayashi's Data (computed) Time	Terman and Hocking's Data Time	Flemming's Data Age	Flemming's Data Time
			H—M	H—M	H—M	Hours	Hours	Hours	Hours	Hours	H—M	H—M	Years	H—M
0— 0/11						16	16		16 to 18					
													0 to 1½	15—05
1— 1/11	11	11	1—42	12—00	13—42	16	15	12 to 14	12 to 13					
													1½ to 2	13—20
2— 2/11	20	18	1—10	11—35	12—45	15	13½ to 14	12 to 14	12 to 13				2 to 2½	12—49
													2½ to 3	12—49
3— 3/11	16	15	1—22	11—30	12—52	14	13½ to 14	12 to 14	10 to 11				3 to 3½	12—34
													3½ to 4	12—26
4— 4/11	9	6	—37	11—30	12—07	13	13½ to 14	12 to 14	10 to 11				4 to 4½	11—57
													4½ to 5	12—06
5— 5/11	7	4	—09	11—21	11—30	12 to 13	13½ to 14	11 to 12					5 to 5½	11—43
													5½ to 6	11—00
6— 6/11	14	0		11—16	11—16			11 to 12		12	9—55	11—14		
7— 7/11	9	0		11—03	11—03			11 to 12		12	10—04	10—41		
8— 8/11	3	0		10—35	10—35			11 to 12		11½	9—49	10—42		
9— 9/11	7	0		10—44	10—44			11 to 12		11	9—44	10—13		
10—11/11	6	0		10—32	10—32			10		11	9—15	9—58		

* Reprinted by permission from "A Study of Sleeping Habits of Children," Nelly Chant and W. E. Blatz, *Genetic Psychology Monographs*, 4 (1): 31, July, 1928.

can place the child on the receptacle a few minutes in advance. In time the elimination which occurred in response to pressure in the bladder and rectum will occur in response to the toilet chair. The reflexes have been conditioned to go off at the tactile sensations associated with the chair rather than at the appearance of the internal pressure sensations.

Training should be begun at not later than one year of age. If possible, it should be begun before that time. Placing the child in the toilet situation at regular intervals, as shown by his records of the time at which accidents are apt to occur, will nearly always be sufficient to set up the dry habit, provided this is kept up for a long period and no unpleasantness is associated with the chair situation. This is the same principle of uniformity of conditions as enunciated in the sections on eating and sleeping. Other conditions should also be uniform. The child should be placed in the same room and approximately in the same place, for here, as in setting up the eating habit, changes in the surrounding conditions often prove distracting.

No distractions should be introduced if it is possible to avoid them. To surround the child's chair with toys or other distracting materials is nearly always to make him attend to these rather than to the sensations which one wishes him to become conscious of. It must be remembered that consciousness of these sensations is one of the three things which, as Blatz states, are preconditions of voluntary control. Scolding, scenes, or any other emotional upsets condition the child to inhibition rather than to elimination. It is an interesting fact that children who have been trained at home, when placed in hospitals under different conditions often show a breaking down of the dry habit. The stimulus to elimination is different and the surrounding conditions

are also different. This is enough to make the habit fail to transfer to the hospital situation. In the hospital, the vessels used differ in shape and the surroundings differ in appearance from the ones to which the child is accustomed. The child does not get the same cutaneous stimulation, nor does he have the same visual sensations. Since the same stimuli are not present, the habit does not function as it does under home conditions. A very little failure of the habit to function results in its loss through disuse since, at the same time, a different habit in relation to the internal pressure sensations is being set up. Children who are taken away from home for a visit also often show a failure of the habit to function unless the conditions surrounding the toilet are as similar to those at home as it is possible to make them.

The times at which training can be expected to be complete varies with different races and different individuals. Woolley* makes the following statement as to the times at which children should be trained but qualifies her statements by emphasizing the probability of wide individual variations. By a year, the child should be familiar with the use of the chair. At eighteen months, he should be "wearing panties and be fairly reliable in the daytime." At two years he should be well trained for daytime, and at two and a half to three years of age, reliable and able to wake himself at night.

Some children are completely trained at eighteen months, but this is rare. In many cases, training is not completed until three and a half. The factors most conducive to the acquisition of voluntary control are: uniformity of condi-

* Woolley, Helen T., "Enuresis as a Psychological Problem," National Committee for Mental Hygiene.

tions as outlined above, patience, a cheerful hopeful attitude on the part of the parent, good physical condition, and the absence of punishment and all exciting scenes during the toilet period.

Causes of failure to train by the end of the third year are: poor physical condition, shaming which results in a child's loss of confidence in himself or in the development of antagonistic attitudes, exciting scenes which make the child the center of attention, punishment producing negativism or fear, too long postponement of the training period, and overcontrol which produces a negativistic attitude.

A four-year-old who had failed to set up the dry habit was found to be in a general state of poor nutrition. The lack of muscular tone was such that it was difficult for him to control the muscles involved in the dry habit and in elimination. Enuresis was overcome when the child's physical condition neared normal.

A three-and-a-half-year-old who was being classed as an enuresis case was found to be controlled solely by the use of shame in connection with his toilet habits. The least lapse had always been met by the statement that he was a baby and would probably never learn to be a big boy. A period of a year during which the parents were retrained as to their attitude to the child and the child trained in confidence in himself was necessary before enuresis was overcome.

A four-year-old, whose mother had forced him to live up to the standards which she had set, used his lack of control in toilet habits as the only weapon against her. He had found that this disturbed her more than any other lapse from good behavior and therefore used it. The mother in

this case had used force to such an extent that when the child refused to eat food, he was held and the food forced down his throat until choking resulted.

It is unnecessary to cite other cases to illustrate the other causes of failure to train on our list, inasmuch as cases of these can be found without great difficulty by those who deal with children in the preschool period.

In cases where training is difficult, the first requisite is a physical examination and the elimination of all physical difficulties if these are present. The second requisite is the control of the diet and cutting down of liquid after four o'clock in the evening. Every attempt should be made to develop children's confidence in themselves. Responsibility for waking up and for dry clothing should be put up to the child, but help should be given in the way of an alarm clock or some similar idea so that the child may get up at the right hour. Successes should be approved but failures should provoke no discussion whatever. All overcontrol, nagging, and the like should be eliminated. The child's whole schedule should be regular and he should have adequate outdoor exercise. No excitements of any kind should ever accompany the toilet situation. The child's failures should never be talked about, even with the other members of the immediate family. All these things and, above all, a hopeful attitude, coupled with endless patience, will usually be sufficient to correct the difficulty where physical defects are corrected.

It must be remembered that children differ enormously both as to the rate at which they acquire new habits and as to the permanence of the habits acquired. Where one child may have no relapses after the second year of age, another may have relapses whenever placed under unusual

strain. Up to the age of six, such relapses should never arouse comment but should be treated as things which have occurred this once but are not apt to occur again.

Bowel control should be acquired long before the dry habit is set up, but this too varies with individual children. The conditions which are a requisite for the setting up of the dry habit must also be secured here.

Play, Toys, and Materials. A number of authorities have treated fully the development of play interests in young children. Dr. Fenton* in her excellent chapter on that subject divides the play life of the child into a number of intervals. In the first and second months, during which the interest is largely sensory and motor, muscular play of the type of kicking and waving the arms, wriggling, cooing, and gurgling, goes on almost indefinitely. For this type of activity, no special play materials are necessary and none should be provided. With the third month, the child begins to have interest in getting hold of objects and in touching. A string of beads or some other smooth hard objects, too large to be swallowed but sufficiently movable to provide contact and to stimulate movement, are types of play materials suggested. These are also excellent for the fourth month. Much of the child's time will be spent in vocalizing and lip movements, including blowing bubbles. In the fifth month, handling objects appears to be emphasized. For this month and the month that follows, beads, rattles with a minimum of noise, and all sorts of hard and soft objects easily cleaned and presenting no fluff or rough pieces which may be swallowed, appear to be the type of materials which stimulate play. At this time, stiff paper

* Fenton, Jessie C., "A Practical Psychology of Babyhood," Chap. II. Houghton Mifflin Company, Boston, 1925.

which rattles and which presents no sharp points and is sufficiently nonpoisonous to be put in the mouth without danger, a rattle, wooden spoons and bowls, soft dolls and animals, and the like may be given the child. Aluminum dishes with rolled edges appear to be a source of much interest. These materials, with a set of very light blocks and linen books of animal pictures, provide sufficient material to the fourteenth month. Additional blocks, wooden trains, toys which may be dragged or pulled, wooden boats with no projecting points, and small smooth boxes may be added to the list during the second year. By the age of two, all the materials usually listed in the equipment of a good nursery school can be used by the children.

The list* of toys suggested by Mrs. Fenton follows.

Ready-made Toys	Home-made Toys
One to three months	
Rattles, strings of beads, celluloid and rubber rings, small animals of rubber or celluloid.	Spools, strings of buttons, light spoons. Chains made by linking large safety pins together.
Three to six months	
Floating celluloid toys for the bath. Bells.	Small lids and covers. A cup and spoon. Clothes-pins. Rattles made of aluminum salt shakers, tea-balls, etc., with small pebbles inside. Sheets of clean crisp paper.
Six to nine months	
Light, wooden blocks. Dolls. Toy animals. Picture books.	Various kitchen utensils: egg-beater, potato masher, wooden butter-paddle, etc. Hard fruits and vegetables of different shapes, such as oranges, cucumbers, small gourds, and squashes.

* Fenton, Jessie C., "A Practical Psychology of Babyhood," Chap. II, p. 54, Houghton Mifflin Company, Boston, 1925. See also Hurlock, Elizabeth, "Child Development," McGraw-Hill Book Company, Inc., New York, 1942.

Nine to twelve months

Nests of hollow blocks or boxes. Blocks. Book to use in turning pages as well as to look at. Balls. All sorts of manipulative toys: an abacus, small games of quoits, etc.

Sets of pans, cups, cans, boxes, etc., which will fit one inside another. Jars, bottles, etc., with removable lids to take off and put on. Boxes or baskets containing a number of small objects, which may be taken in and out. Handfuls of old post-cards, etc.

Twelve to fifteen months

Primers with simple stories. Toys to drag or pull about: a small wagon or wheelbarrow, a bell mounted on wheels, toy animals set on wheels, etc. (Such toys should be solid and not too easily tipped over. A two-wheeled cart or wheel-barrow is better than a four-wheeled one, because less liable to upset in turning corners.) Toy replicas of household articles: iron, broom, shovel, doll's furniture, etc. Toy chair to sit on.

A cylindrical can or carton impaled on a string or wire so that it will roll as it is dragged about is often even better than toys with wheels at this stage, because it turns in any direction readily without upsetting. Pebbles, a bell, or something of the sort, may be put inside to make a noise. Empty boxes and cartons.

Fifteen to eighteen months

Toy trains, autos, etc. More miniature household articles. Crayons and pencils to mark with, toy blackboards, slates, etc.

A box to climb upon (an apple box of a good size to climb into and out of. Care should be taken that there are no nails, splinters, etc.). A plank raised at one or both ends to walk on and bounce on.

Eighteen to twenty-four months

A sand pile. Bucket and shovel, shells, various toys for digging, etc. Toys which enable the child to re-enact his own real experiences, such as toy airships, farm implements, trains, doll carriages—whatever he has encountered and enjoyed in real life. A swing. More elaborate blocks.

Scrapbooks, made by pasting pictures cut from magazines, etc., in blank books or books made of heavy butcher's paper. Blocks made of left-over lumber, etc.

The play life of children of nursery-school age and their choices of toys and occupational materials have been the subject of several recent investigations. Atkins' study of two-year-olds in a nursery group yields the list of toys chosen during the year as shown on page 450, with the number of times each was used in a group or in individual play.

The children for this study* were ten two-year-olds—five boys and five girls. The children were observed for the first hour of every morning, and the materials which they selected, the length of time each material was used, and the number of children in the group were recorded. While the study is based on too few subjects to permit of any generalization, the types of toys chosen frequently are, nevertheless, of interest, in that they indicate the unpopular and popular material in this two-year-old group.

A similar study conducted by Bridges† in McGill University yields somewhat different results as to the choice of toys and materials. The subjects for this study were ten children—six girls and four boys, ranging in age from two years and six months to three years and eight months, with an average age of two years and eleven months at the time at which the investigation was begun. They were observed for several weeks during a free play hour from eleven to twelve noon. As with the subjects in this study previously cited, the children were permitted to make use of any material which they liked for any length of time. The three occupations most frequently chosen were the cylinders,

* Atkins, Cornelia, "A Study of the Changes in Play Interests with Increasing Maturity," Master's Thesis, on file in the Library of the University of Cincinnati.

† Bridges, K. M. Banham, "Occupational Interests of Three-year-old Children," *Pedagogical Seminary and Journal of Genetic Psychology*, 1927.

TABLE IX

Group		Boys		Girls	
Toys	No. times	Toys	No. times	Toys	No. times
Boxes	225	Boxes	150	Boxes	75
Kiddy-car	185	Kiddy-car	110	Kiddy-car	75
Slide	126	Train	98	Slide	64
Sand	120	Blocks	77	Sand	62
Train	115	Boards	62	Velocipede	50
Blocks	101	Slide	62	Dishes	39
Velocipede	98	Sand	58	Boards	33
Boards	95	Jungle gym	53	Clay	29
Wagon	72	Wagon	50	Blocks	24
Jungle gym	68	Velocipede	48	Wagon	22
Truck	58	Truck	45	Train	17
Clay	47	Double ladder	38	Jungle gym	15
Double ladder	44	Clay	18	Dolls	14
Dishes	44	Ball	10	Truck	13
Ball	19	Beads	8	Paints	12
Paints	17	Dishes	5	Hammer	10
Dolls	14	Paints	5	Balls	9
Hammer	14	Teeter totter	5	Doll carriage	7
Beads	13	Insets	4	Insets	7
Insets	11	Hammer	4	Brooms	7
Animals	9	Wheelbarrow	3	Doll clothes	6
Doll clothes	8	Animals	3	Animals	6
Broom	8	Crayons	2	Double ladder	6
Teeter totter	8	Doll clothes	2	Beads	5
Doll carriage	7	Broom	1	Wheelbarrow	3
Wheelbarrow	6			Teeter totter	3
Saw	3			Saw	3
Crayons	3			Peg boards	2
Peg boards	2			Crayons	1

the bricks, and the color pairs. The five occupations selected least frequently were the Montessori Pink Tower, sweeping with brush and pan, lacing material on the frames, playing with stuffed animals, and the tea set. Bridges calls

attention to the enormous individual variation in the choice of toys, which was also characteristic of the children in the experiment previously cited. There seemed to be some sex difference in interests. The boys appeared to prefer building with large bricks while the girls showed preference for fitting cylinders of graded sizes into holes and for matching colors. Bridges states that "we may expect girls to prefer work with their fingers and to want to change their occupations a little less frequently than boys." In Bridges's experiment, one little girl played very frequently with a doll and a doll bed, while another chose frequently a buttoning frame, and a third, doll beds.

The chief interest of Bridges's study was the length of time during which the children were interested in any one occupation. The boys usually stayed about seven minutes while the girls stayed about nine. This experimenter states that if the change of occupations after a relatively short period holds as true of the home as it does of the nursery, we should expect children to change occupations about every five to ten minutes. Boys should be expected to be more active than girls but to show a tendency to spend a longer time at a favorite occupation. Atkins does not find such sex differences as are here indicated. She finds an enormous individual variation in the length of time during which children play with a certain object. There is a range in the median score for a length of time at any one thing from five minutes in the case of one subject to thirteen minutes in the case of a subject representing the other extreme.

Bott,* in a similar study, comes to somewhat different conclusions as to the type of materials chosen. The subjects

* Bott, Helen, "Observation of Play Activities in a Nursery School," *Genetic Psychology Monographs*, 4 (No. 1): 44–87, July, 1928.

TABLE X.—CLASSIFICATION OF PLAY MATERIALS WITH THE TIME (IN MINUTES) SPENT ON THEM BY AGE GROUPS*

Type of specimens	A 2–3 yr.	B 3–4 yr.	C over 4 yr.	Total minutes
Pattern toys				
Beads	4	29	80	
Puzzles	...	16	61	
Tinker builder	39	8	56	
Peg board	69	74	44	
Wooden doll	12	24	24	
Peg man	15	5	12	
Disc board	7	5		
	146	161	277	584
Raw materials				
Beans	77	55	73	
Big blocks	61	74	59	
Color cubes	6	27	25	
Black board and chalk	27	26	14	
Spools	7	1	8	
Small blocks	4	9	3	
	182	192	182	556
Locomotor toys				
Sectional train	33	38	41	
Tricycle	6	2	33	
Wagon	19	34	28	
Kiddy kar	40	15	21	
Dump truck	13	5	17	
Doll's carriage	32	2	11	
Ball	3	4	5	
Hobby horse	13			
	159	100	156	415
Small mechanical toys	141	61	38	240
Unclassified				
Doll	28	1	9	
Picture books	17	35	27	
Dishes	2	3		
	47	39	36	122
Total minutes	675	553	689	1917

* Reprinted by permission from "Observations of Play Activities in a Nursery School." Helen Bott, *Genetic Psychology Monographs*, 4 (1): 44–87, July, 1928.

for her study were fifteen children between the ages of two and five. The table* summarizing the results of this study is cited in its entirety, though only nine children are re-

* *Ibid.*, p. 75.

ported upon—three in each of the age groups, two to three, three to four, and four to five years. The observations were kept in the form of sort of a diary record. The children showed a threefold division of interest: in the materials used in play, in the adults in charge of the school, and in the other children with whom the children played. All five types of materials—locomotor toys, raw materials, pattern, mechanical, and unclassified toys—are used at each age. With two-year-olds, raw materials are used most frequently.

TABLE XI.—SUMMARY: PER CENT OF TIME SPENT BY EACH AGE GROUP ON FOUR TYPES OF TOYS

A		B		C	
Type	Time, per cent	Type	Time, per cent	Type	Time, per cent
Raw materials	29.0	Raw materials	37.4	Pattern	42.4
Locomotor	25.3	Pattern	31.3	Raw materials	27.9
Pattern	23.2	Locomotor	19.4	Locomotor	23.9
Mechanical	22.5	Mechanical	11.9	Mechanical	5.8

Locomotor toys, pattern toys, and mechanical toys follow in the order listed. The youngest children are not greatly interested in pattern materials, while with the four-year-olds this type of material stands first. Throughout, there is a pronounced preference for large over small blocks. Locomotor toys are very popular. The general conclusions of this study were (*a*) raw materials should be provided for all preschool children; (*b*) locomotor toys are useful but decrease in usefulness as the child grows older, while pattern toys gain in appeal; (*c*) mechanical toys appear to have little value at any period.

The span of attention in play situations appeared to be as follows: On the average, two-year-olds attend for from two to three minutes; three-year-olds, for from four to five minutes; and four-year-olds for from five to six minutes.

While the number of subjects in each of these investigations is too small to permit of wide generalization, and the age range of these subjects too wide, the results are indicative of certain trends in child behavior. The choice of toys associated with activity, the use of locomotor toys and blocks, stand out in two of the three studies. The short period during which children may be expected to attend is also significant, though the children cited by the three investigators differed somewhat widely in the length of time during which they attended to any one occupation or object. Further investigation is necessary before any final conclusions can be drawn as to the choice of toys and play materials, the type of play to be expected, and the duration of attention in early childhood, but the researches cited throw a good deal of light on all three subjects.

Such a list of toys* as the following probably covers the types of interest shown during early childhood.

Toys for House Play

Doll beds, carriages.
Stoves.
Wash tubs, wash board, clothes-pins.
Chest of drawers containing doll clothes.
Brooms, sweepers.
Unbreakable dishes.
Kitchen utensils: egg beaters, potato masher, flour sifter.
Screen play house: tea party.
Chairs and tables.

* For assistance in compiling this list, the author is indebted to Miss Afton Smith and Miss Marie Acomb.

BLOCKS

Nest of blocks.
Large cubes and bricks.
Architectural blocks.
Large maple blocks: cut to order
$2 \times 4 \times 24''$
$2 \times 4 \times 8''$
$\frac{3}{4} \times 9 \times 24''$

TOYS FOR BLOCK PLAY

Toy animals.
A set of trees.
Noah's ark.
Doll house families.

DOLLS

Unbreakable.
Rag dolls.

ARTS AND CRAFTS MATERIAL

Modelling clay or plasticine.
Paints: nonpoisonous water colors—provide paper and rubber aprons.
Crayons and drawing paper.
Scissors, paste, and construction paper.
Hammer, large nails, and soft wood.

TOYS FOR ACTIVE PLAY

Pulling toys: carts, wheelbarrow, toy animals on wheels, wagons.
Riding toys: velocipede.
Kiddy-car.
Trains, trucks, autos, etc.
Horse reins.
Balls, several sizes.

OUT-DOOR PLAYTHINGS

Sand box and sand toys.
See-saw.
Slide.
Climbing ladder.
Yard blocks, boxes.
Swing.

MANIPULATIVE MATERIAL

Wooden beads for stringing, large size 1″ in diameter.
Montessori material.

While Dr. Fenton's list is to be preferred for choice of toys to eighteen months of age, the above, cited from "The Child from One to Six,"* covers the range of materials in use in many progressive nursery schools.

Further research is necessary in all branches of play and toy materials, particularly as to which are used under different conditions at different age levels, and as to the type of toys in use in dramatic and individual play.

EXERCISE

I. Determine for your child the following facts in connection with habits of eating, sleep and rest, exercise, and toilet habits.†

* ARLITT, ADA HART, McGraw-Hill Book Company, Inc., 1930.

† For assistance in compiling the following, the author is indebted to Miss Ellen Kleppe, Miss Afton Smith, and Miss Cornelia Atkins.

13. CAMPBELL, RUTH: "A Study of the Diets and Some Health Habits of Children in a College Community," Master's Thesis, Kansas State Agricultural College, Manhattan, Kan., 1924.

14. CHADWICK, MARY: "Psychological Basis of the Refusal of Food by Children and the Loss of Appetite," *Journal of Proceedings*, The Child Study Society, London, **17**: 24–27, 1927.

15. CLARKE, T. W.: "Anorexia in Children," *New York State Journal of Medicine*, **24**: 329, 1924.

16. DANIELS, A. L., and GLADYS J. EVERSON: "A Study of Anorexia in Pre-school Children," *Journal of Home Economics*, **27**: 43–49, 1935.

17. DAVIS, CLARA M.: "A Practical Application of Some Lessons of the Self-Selection of Diet Study to the Feeding of Children in Hospitals," *American Journal of Diseases of Childhood*, **46**: 743–750, 1933.

18. DAVIS, CLARA M.: "Self-selection of Diet by Newly Weaned Infants: an Experimental Study," *American Journal of Diseases of Childhood*, **36**: 651–679, 1928.

19. DUNCKER, K.: "Experimental Modification of Children's Food Preferences through Social Suggestion," *Journal of Abnormal Psychology*, **33**: 489–507, 1938.

20. DUNSHEE, W. E.: "A Study of Factors Affecting the Amount and Kind of Food Eaten by Nursery School Children," *Child Development*, **2**: 163–183, 1931.

21. ELIOT, A. A.: "Eating Habits in Relation to Personality Development of Two and Three Year Old Children," *Genetic Psychology Monographs*, **13**: 399–481, 1933.

22. GESELL, ARNOLD: "Feeding Behavior of Infants," J. B. Lippincott Company, Philadelphia, 1937.

23. GESELL, ARNOLD: "The Psychological Hygiene of Infant Feeding," *Mental Hygiene*, **22**: 216–220, 1938.

24. KELTING, LILLIAN SOPHIA: "An Investigation of the Feeding, Sleeping, Crying and Social Behavior of Infants," *Journal of Experimental Education*, **3**: 98–101, 1934–1935.

25. KUGELMASS, I. N., and E. L. SAMUEL: "Raw Basic Feeding in Anorexia of Children," *Archives of Pediatrics*, **48**: 43–49, 1931.

26. LOW, M. B.: "Anorexia in Children," *New England Journal of Medicine*, **214**: 834, 1936.

27. LUCAS, W. P., and H. PRYOR: "Factors Involved in Combating the Hunger Strike in Children," *American Journal of Diseases of Childhood*, **41**: 249–261, 1931.

28. McCarthy, Dorothea: "Children's Feeding Problems in Relation to the Food Aversions in the Family," *Child Development*, **6**: 277–284, 1935.

29. McKay, H., and M. B. Patton: "Food Used by Pre-School Children During Winter and Spring," Abs. *Journal of Home Economics*, **24**: 925–926, 1932.

30. McLaughlin, L., M. Tarwater, M. Lowenburg, and G. Koch: "Vegetables in the Diet of Preschool Children," *Journal of Nutrition*, **4**: 115–125, 1931.

31. Maclay, Eleanor: "A Study of the Prevalence of and Lack of Appetite in One Hundred Preschool Children," Master's Thesis, University of Chicago, 1924.

32. Maclay, Eleanor R., and Ellen Kleppe: "The Selection of Food for Children and Formation of Good Food Habits," Bulletin.

33. Miller, R. J., O. Bergeim, M. E. Rehfuss, and P. B. Hawk: "Gastric Response to Foods, XIII; the Influence of Sugars and Candies on Gastric Secretion," *American Journal of Physiology*, **53**: 65, 1920.

34. Mohr, George J.: "Emotional Factors in Nutritional Work with Children," *Mental Hygiene*, **12**: 366–377, 1928.

35. Morgan, A. F., G. D. Hatfield, and M. A. Tanner: "A Comparison of the Effects of Supplementary Feeding of Fruits and Milk on the Growth of Children," *American Journal of Diseases of Childhood*, **32**: 839, 1926.

36. Moseley, M. R.: "Reactions to Food of Children of Preschool Age," Master's Thesis, University of Chicago, 1925.

37. "Nursery School Feeding—A Symposium: Balancing of Arms in Nursery School Feeding," Staff of Nursery School, New York State College of Home Economics, Cornell University, *Journal of Home Economics*, **28**: 373–376, 1936.

38. Poull, L. E.: "The Effect of Improvement in Nutrition on the Mental Capacity of Young Children," *Child Development*, **9**: 123–126, 1938.

39. Prentiss, Sara W., and Mary Cover Jones: "The Observation of Food Habits in Young Children," *Childhood Education*, **7**: 14, 1930.

40. Prevey, Esther: "Nursery School Feeding—A Symposium: Self Service in a Nursery School," *Journal of Home Economics*, **28**: 376–379, June, 1936.

41. Ripin, R.: "A Study of the Infant's Feeding Reactions During the First Six Months of Life," *Archives of Psychology*, **18**: (No. 116): 5–44, 1930.

42. Schmidt, C. R.: "Psychology of Child Nutrition," *Journal of Home Economics*, **17**: 260–264, May, 1935.

43. SCHULTZ, F. W.: "The Problem of Chronic Anorexia in Childhood," *Journal of the American Medical Association*, **94**: 73–77, 1930.

44. STAPLES, R., and A. C. ANDERSON: "A Study of Outdoor Play, Appetite, and Afternoon Sleep of Young Children," *Child Development*, **4**: 191–195, 1933.

45. STOLZ, HERBERT R.: "Eating Problems among Nursery School Children," *Food Facts*, **4**: 1–8, 1928.

46. SWEET, CLIFFORD: "My Child Won't Eat," *Archives of Pediatrics*, **47**: 588, 1930.

47. SWEET, CLIFFORD: "Voluntary Food Habits of Normal Children," *Journal of the American Medical Association*, **107**: 765–766, 1936.

48. THOM, D. A.: "Feeding Habit Clinics for the Child of Preschool Age," Bureau Publication 135, United States Department of Labor, Children's Bureau.

49. THURSTON, F. M.: "A Preliminary Study of the Factors Affecting the Time Taken by Nursery Children to Eat Their Food," *Journal of Genetic Psychology*, **36**: 303–318, 1929.

50. VANCE, T. F.: "Food Selections of Nursery School Children," *Child Development*, **3**: 169–175, 1932.

51. VANCE, T. F., and V. M. TEMPLE: "The Food Preferences of Preschool Children: A Comparison of Rural Children with Children of the Iowa State College Nursery School," *Child Development*, **4**: 222–228, 1933.

52. VON HOFE, F. H.: "Anorexia in Early Childhood," *Journal of the Medical Society of New Jersey*, **21**: 55–56, 1924.

53. WADI, TOMI: "An Experimental Study of Hunger in its Relation to Activity," *Archives of Psychology*, 57, 1922.

54. WEST, DR. J. M., "Alterations in the Mechanics of the Gastro-intestinal Tract as a Cause of Poor Appetite in Children," *Pennsylvania Medical Journal*, **32** (9): 609–611, 1929.

55. YERKES, LOLA G.: "A Study of the Causes of Anorexia among Fifty Preschool Children," Master's Thesis, University of Cincinnati, 1930.

SLEEP

1. BOYNTON, M. A., and GOODENOUGH, FLORENCE S.: "The Posture of Nursery School Children During Sleep," *American Journal of Psychology*, **40**: 270–278, 1930.

2. CHANT, N., and W. E. BLATZ: "Study of Sleeping Habits of Children," *Genetic Psychology Monographs*, **4**: 13–42, 1928.

3. Flemming, B.: "Study of Sleep of Young Children," *Journal of the American Association of University Women*, 25–27, 1925.

4. Scott, E. A.: "A Study of the Sleeping Habits of Twenty-nine Children of Preschool Age," *Child Development*, **2**: 326–328, 1931.

5. White, M. R., "Some Factors Affecting the Night Sleep of Children," *Child Development*, **2**: 234–235, 1931.

6. Woolley, Helen T.: "Eating, Sleeping and Elimination," in Carl Murchison, editor, "Handbook of Child Psychology," Clark University Press, Worcester, 1931.

Play

1. Hurlock, E. B.: "Experimental Investigations of Childhood Play," *Psychological Bulletin*, **31**: 47–66, 1934.

2. Lehman, H. C.: "Community Differences in Play Behavior," *Pedagogical Seminary*, **33**: 477–490, 1926.

3. Lehman, H. C.: "A Comparison of the Play Activities of Town and Country Children," *Pedagogical Seminary*, **33**: 455–476, 1926.

4. Lehman, H. C.: "Growth Stages in Play Behavior," *Pedagogical Seminary*, **33**: 273–288, 1926.

5. Timme, A. R.: "Significance of Play and Recreation in Civilized Life," *Mental Hygiene*, **18**: 51–57, 1934.

AUTHOR INDEX

R

S